# $test.html

# Test Page

This is just a test file to check that $ works ok in file names

# administration.html

[**Identification**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html)

**Individuals:**

* [Patient](patient.html)
* [Practitioner](practitioner.html)
* [RelatedPerson](relatedperson.html)

**Groups:**

* [Group](group.html)
* [HealthcareService](healthcareservice.html)
* [Organization](organization.html)

**Entities:**

* [Location](location.html)
* [Person](person.html)
* [Substance](substance.html)

**Devices:**

* [Device](device.html)
* [DeviceComponent](devicecomponent.html)
* [DeviceMetric](devicemetric.html)

[**Workflow**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html)

**Patient Management:**

* [Encounter](encounter.html)
* [EpisodeOfCare](episodeofcare.html)
* [Flag](flag.html)
* [Communication](communication.html)

**Scheduling:**

* [Appointment](appointment.html)
* [AppointmentResponse](appointmentresponse.html)
* [Schedule](schedule.html)
* [Slot](slot.html)

**Workflow #1:**

* [Order](order.html)
* [OrderResponse](orderresponse.html)
* [DeviceUseRequest](deviceuserequest.html)
* [DeviceUseStatement](deviceusestatement.html)
* [CommunicationRequest](communicationrequest.html)

**Workflow #2:**

* [ProcessRequest](processrequest.html)
* [ProcessResponse](processresponse.html)
* [SupplyRequest](supplyrequest.html)
* [SupplyDelivery](supplydelivery.html)

## Administrative Resources

|  |  |  |
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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

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| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| Note: *The PA work-group would appreciate contributions to enhance the appointment resource(s) to cover additional use-cases if required for implementations* | | |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |

Additional Resources will be added in the future. A list of hypothesized resources can be found on the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR_Resource_Types). Feel free to add any you think are missing or engage with one of the [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm) to submit a [proposal](http://wiki.hl7.org/index.php?title=Category:FHIR_Resource_Proposal) to define a resource of particular interest.

# backboneelement-definitions.html

## BackboneElement - Detailed Descriptions

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### BackboneElement

# backboneelement.html

# BackboneElement

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The base definition for elements defined as part of a resource definition. [Data Type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) elements do not use this type. For instance, [Patient.contact](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#resource) is an element that is defined as part of the patient resource, so it automatically has the type BackboneElement.

Note that the descendent types of BackboneElement are all declared implicitly as part of the definitions of the resources.

## Content

## Specializations

This table lists all the specializations of BackboneElement that are defined, and the path at which they are defined.

# ballot-intro.html

## DSTU 2 Ballot Welcome

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [None](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Hello and welcome to the second FHIR DSTU ballot!

This specification represents a series of significant changes and enhancements from the first FHIR Draft Standard for Trial Use specification HL7 published in January, 2014. It includes a number of new resources including support for claims and scheduling as well as publish/subscribe and operations. It also includes changes resulting from over 1500 change proposals submitted by implementers and other readers of the specification. A complete list of changes can be found [here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html).

While FHIR is not yet "normative", this specification is the product of many thousands of hours of development, including several ballot cycles, multiple QA cycles, 8 Connectathons and production of a number of reference and proof of concept implementations. Subsets of FHIR have been implemented or are currently being implemented on all continents other than Antarctica. Therefore we hope that you find the specification already close to an implementable state.

The FHIR specification is presented as a series of interlinked HTML pages. They can either be reviewed online or can be [downloaded](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-spec.zip) for exploration on your own device. (70MB zip, 550MB unzipped). You can review whichever links are of interest in any order you wish. However, to ensure a base level understanding of the specification we recommend that you click on the [Documentation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentation.html) link and read through at least the following:

For context:

* Overview/[1 page Summary (Glossy)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\summary.html)
* Overview/[Developer's Introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-dev.html)
* Overview/[Clinical Introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-clinical.html)
* Overview/[Overview & Roadmap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview.html)
* Overview/[FHIR Timelines](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html)

To see scope:

* Click on the [Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) link at the top to get a sense of what resources exist and maybe drill into a couple of them to see what they look like before coming back to the Documentation tab for more context

To understand base approach:

* Resources/[Base Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html)
* Resources/[DomainResource](file:///C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\domainresource.html)
* Resources/[Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* Resources/[Formats: XML, JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html)
* Resources/[Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)

To understand key infrastructure:

* Resources/[Data Types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html)
* Terminologies/[Using Codes in Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html)

For context for this ballot:

* Administration/[Outstanding Issues](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\todo.html)

Feel free to drill down into any other sections of interest. If you want to ensure a complete review of the whole spec, the Documentation/Administration/[Table of Contents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\toc.html) may be a useful guide.

A few notes to consider:

* A few artifacts (generally resources) have been flagged as "draft". This means that the work group authoring the content and/or the FHIR Management Group feels that the content is not yet sufficiently robust or complete for production use. Implementers may choose to implement these artifacts anyhow, but should proceed with caution and may find that more adaptation or extension will be required than for a typical resource. It is expected that "draft" resources will progress to DSTU as part of the next release. (Implementers may also want to check the [Continuous Integration Build](http://hl7-fhir.github.io/) for more up-to-date versions of these resources.)
* Not all of the outstanding issues will be resolved prior to the DSTU ballot passing. Some may be left open to allow feedback from the early adopter community.
* This specification is complete enough to be implementable in a variety of healthcare scenarios, including supporting all "Common Meaningful Use Data Set" and and much other content from from the Consolidated CDA implementation guide. However, the set of resources is not complete. Resources may evolve and new ones will be introduced over time. Refer to [FHIR Timelines](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html) for additional guidance on expectations around the evolution of the FHIR specification.

### Balloting

HL7 ballot rules require that participants sign up prior to opening of the ballot. If you did not sign up in advance, please still submit comments using the [Propose a Change](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemAdd&tracker_id=677) link at the bottom of each page of the specification. Feedback from balloters will be given priority, but all suggestions will be considered as much as time allows. (And be sure to [sign up](http://wiki.hl7.org/index.php?title=FHIR_email_list_subscription_instructions) to the FHIR list-server and/or follow the [#FHIR](https://twitter.com/hashtag/fhir) hash-tag so you don't miss the chance to vote in the next ballot cycle.)

If you are signed up to ballot, you can download the balloting spreadsheet from the [Ballot Desktop](http://www.hl7.org/participate/onlineballoting.cfm). All ballot feedback must be provided using the spreadsheet template provided. (There's a help tab that explains the meaning of each of the columns.) For FHIR, you have the option of making your comments directly in the spreadsheet or submitting your comment using the FHIR [Change Tracker](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse) tool. If you take the latter approach, you **must** include a reference to each tracker item in your ballot spreadsheet along with a vote (negative-major, affirmative typo, etc.). All spreadsheets must be submitted along with an overall vote by end of day Eastern time on the designated ballot closure date for the comments to be considered as part of ballot disposition.

Note: By using the tracker, you reduce some of the administrative effort of managing the ballot process. As well, you will receive notifications when comments are made on your ballot comment as well as when dispositions are made. Comments not submitted to the tracker as part of the ballot process will be migrated to the tracker after all ballot submissions are received.

When submitting your ballot feedback, if you have a general comment on something that you see occurring multiple times, please include at least a couple of specific locations where you see the issue. As much as possible, capture each separate concern as a distinct row in the ballot sheet or separate [tracker item](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse). (If using tracker items for your submissions, you **MUST** still submit a ballot spreadsheet referencing the relevant tracker items.) It makes our job of reconciling much easier. Also, don't forget to fill in the section numbers (gray numbers to the left of each heading) and URLs.

If you have questions that are interfering with the ability to review the specification or submit ballot comments, please contact one of the co-chairs of the FHIR Management Group: [Lloyd McKenzie](mailto:lloyd@lmckenzie.com) or [David Hay](mailto:david.hay25@gmail.com).

Thanks for taking the time to review the FHIR specification. We appreciate any feedback you can provide.

The HL7 FHIR Management Group (FMG)

# book.html

# Fast Health Interoperability Resources (FHIR) v

**Warning: This version of FHIR is the DSTU ballot, and the stable version for the September/October connectathons. Implementers are welcome to experiment with the content defined here, but should note that the contents are subject to change without prior notice.**

## Table of Contents

# cda-intro.html

## Clinical Document Architecture (CDA) on FHIR

|  |  |  |
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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 0 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### What is CDA on FHIR?

CDA on FHIR specifies how to implement CDA R2 with the FHIR [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) resource.  
The original HL7 Clinical Document Architecture (CDA) defined the structure and semantics of "clinical documents" for the purpose of exchange. A clinical document is a documentation of clinical observations and services, with the following characteristics:

* Persistence - A clinical document continues to exist in an unaltered state, for a time period defined by local and regulatory requirements (NOTE: There is a distinct scope of persistence for a clinical document, independent of the persistence of any XML-encoded CDA document instance).
* Stewardship - A clinical document is maintained by an organization entrusted with its care.
* Potential for authentication - A clinical document is an assemblage of information that is intended to be legally authenticated.
* Context - A clinical document establishes the context for its contents.
* Wholeness - Authentication of a clinical document applies to the whole and does not apply to portions of the document without the full context of the document.
* Human readability - A clinical document is human readable.

A CDA document on FHIR is a defined and complete information object that can include text, images, sounds, and other multimedia content.

### Scope of the CDA on FHIR

The scope of CDA on FHIR is the standardization of clinical documents for exchange.  
  
The data format of clinical documents outside of the exchange context (e.g., the data format used to store clinical documents) is not addressed in this specification.  
  
CDA on FHIR does not specify the creation or management of documents, only their exchange markup. While it may be possible to directly use the CDA Schema in a document authoring environment, such use is not the primary purpose of the CDA specification.  
  
Document management is critically interdependent with the CDA specifications, but the specification of document management messages is outside the scope of the CDA.

### Goals and Design Principles

The goals of the CDA on FHIR are:

* Give priority to delivery of patient care.
* Allow cost effective implementation across as wide a spectrum of systems as possible.
* Support exchange of human-readable documents between users, including those with different levels of technical sophistication.
* Promote longevity of all information encoded according to this architecture.
* Enable a wide range of post-exchange processing applications.
* Be compatible with a wide range of document creation applications.
* Promote exchange that is independent of the underlying transfer or storage mechanism.
* Prepare the design reasonably quickly.
* Enable policy-makers to control their own information requirements without extension to this specification.

A number of design principles follow from consideration of the above goals:

* This architecture must be compatible with XML and JSON.
* This architecture must be compatible with representations of clinical information arising from other HL7 committees.
* Technical barriers to use of the architecture should be minimized.
* The architecture specifies the representation of instances required for exchange.
* The architecture should impose minimal constraints or requirements on document structure and content required for exchange.
* The architecture must be scalable to accommodate fine-grained markup such as highly structured text and coded data.
* Document specifications based on this architecture should accommodate such constraints and requirements as supplied by appropriate professional, commercial, and regulatory agencies.
* Document specifications for document creation and processing, if intended for exchange, should map to this exchange architecture.
* CDA documents must be human readable using widely-available and commonly-deployed XML-aware browsers and print drivers and a generic CDA style sheet written in a standard style sheet language.
* Use open standards.

## General CDA on FHIR Concepts

### Major Components of a CDA on FHIR Document

This section serves as a high-level introduction to the major components of a CDA document, all of which are described again and in greater detail later on. The intent here is to familiarize the reader with the high-level concepts to facilitate an understanding of the sections that follow. [EDITORS: in CDA r2 there is a bunch of detail about how CDA is wrapped - and an example. Consider whether the discussion is relevant here: "A CDA document is wrapped by the <ClinicalDocument> element, and contains a header..."]

### Human Readability and Rendering CDA Documents

The CDA requirement for human readability guarantees that a receiver of a CDA document can algorithmically display the clinical content of the note on a standard Web browser.

* There must be a deterministic way for a recipient of an arbitrary CDA document to render the attested content.
* Human readability shall not require a sender to transmit a special style sheet along with a CDA document. It must be possible to render all CDA documents with a single style sheet and general-market display tools.
* Human readability applies to the authenticated content. There may be additional information conveyed in the document that is there primarily for machine processing that is not authenticated and need not be rendered.
* When structured content is derived from narrative, there must be a mechanism to describe the process (e.g. by author, by human coder, by natural language processing algorithm, by specific software) by which machine-processable portions were derived from a block of narrative.
* When narrative is derived from structured content, there must be a mechanism to identify the process by which narrative was generated from structured data.

These principles and requirements have led to the current approach, where the material to be rendered is placed into the Section.content...[EDITORS: current design doesn't make it clear where to consistently find narrative]

# change.html

## Appendix: The Role of Informatics in the Shift from Reactive to Proactive Healthcare

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR offers more than a standard solving existing problems in interoperability, it provides a platform for the future. Interoperability is â€˜all about the peopleâ€™; to get past the peak of inflated expectations to the plateau of productivity on [the hype cycle](https://en.wikipedia.org/wiki/Hype_cycle) it is imperative that there is a shared vision of what is trying to be achieved. Healthcare is in the midst of a transformation driven by the convergence of biological and information revolutions and by economic imperative and social change.. FHIRâ€™s strength lies in it being grounded in the real world which is changing rapidly. This appendix offers a high-level view of the disruption underway and helps place FHIR into a wider context.

Just as John Snow used a branch of informatics, geospatial analysis, to identify the source of cholera in London and so prove the germ theory and revolutionize medicine in 1854, so too will the application of informatics and associated technology be instrumental in the next big change in healthcare.

In countries with advanced economies, health systems are facing increased demand from aging populations and increased incidence of chronic disease. In many of these countries, there is also a shortage of skilled workers. Mounting evidence points to avoidable errors causing serious harm to patients. Indeed optimal care only occurs about half the time in even the best performing health systems (1). Small incremental improvements will not be enough to address the looming crisis in sustainable healthcare.

Convergence of trends in health care, biology, informatics and technology together with the associated social changes and economic imperative is driving a paradigm shift (2) that may be the answer. Informatics has a role in most aspects of this. The figure below provides a summary of the convergence of these trends and the likely results of disruption that will move us from reactive to proactive healthcare.

In terms of our understanding of physiological pathways, informatics is now the major tool of molecular biology. For example, the time spent computing exceeds chemical analysis for gene sequencing by 3 to 1. Informatics is being used to map neural networks and to build the models of systems biology (3) with ever increasing levels of precision and complexity that can't be done without the help of machines. Our understanding has changed so much in recent times that the American Academy of Science is now arguing that it is time for a new taxonomy (4).

Personalization is occurring both because of social change and increased biological knowledge and is being facilitated by cheap mobile computing, sensors and devices. These social forces and the enabling technologies are allowing greater participation by 'non-experts' in decision making, treatment, discovery and knowledge management.

Greater knowledge about how we think (5), advances in the information sciences and the increased availability of computing power means that our capacity to acquire knowledge and use it to predict the course of pathology has increased enormously, and that is fortuitous, because the explosion of information is impossible to deal with otherwise. These new capabilities can be used to provide better advice and to better prevent disease through discovery, monitoring and treatment.

The health system itself can also benefit from what looks like a second phase of utilization of information technology through on-line care provision, real integrated measurement of quality and integration of knowledge in work-flow. With openness and transparency there is also the prospect of co-opetition (cooperative competition) and with integrated outcome measures that pay-for-success contracting can be used as an economic lever.

Large scale change in the way healthcare is done is both essential and inevitable. It is likely that this will derive from the merging of the knowledge and machines of the biological and information revolutions facilitating a shift from reactive treatment to proactive personalized medicine. Only by such significant changes could the needed quantum improvement in the effectiveness and efficiency of healthcare be made.

The development of digital technology has disrupted other sectors, notably media, retail and manufacturing, and the health sector is unlikely to remain immune (6). Digitization of biology and health will allow machines to help, lead to a demystification of disease, the democratization of healthcare, and a move from the treatment of disease to the promotion and maintenance of wellness.

**References**

1. CareTrack: assessing the appropriateness of health care delivery in Australia. Runciman WB, Hunt TD, Hannaford NA, Hibbert PD, Westbrook JI, Coiera EW, Day RO, Hindmarsh DM, McGlynn EA, Braithwaite J. 2, 16 July 2012, Med J Aust. 2012 Jul 16;197(2):100-5. PubMed PMID: 227, Vol. 197(2), pp. 100-5
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4. Board on Life Sciences, Committee on A Framework for Developing a New Taxonomy of Disease. Toward Precision Medicine; Building a Knowledge Network for Biomedical Research and a New Taxonomy of Disease. Washington, DC : The National Academic Press, 2011
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# changelist.html

## FHIR Change History

# clinical.html

## Clinical Resources

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

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| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |

Additional Resources will be added in the future. A list of hypothesized resources can be found on the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR_Resource_Types). Feel free to add any you think are missing or engage with one of the [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm) to submit a [proposal](http://wiki.hl7.org/index.php?title=Category:FHIR_Resource_Proposal) to define a resource of particular interest.

# comparison-cda.html

## Clinical Document Architecture (CDA)

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

CDA is HL7's most widely adopted V3 standard. It provides both a standardized header containing metadata about the document as well as the ability to convey a wide variety of clinical content organized into various sections. The document content can be un-encoded, such as a PDF through to a fully encoded V3 instance.

NOTE: While FHIR can be used to create [documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) using the [Composition Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html), FHIR can also be used to exchange traditional CDA R2 documents making use of the [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) resource, and handling the CDA document itself as a binary attachment (as XDS does).

### CDA Similarities and Differences

**Clinical document focus:** As its name implies, Clinical Document Architecture is limited "clinical" use cases. The CDA model does not support exchange of content not deemed to have clinical relevance, such as financial information and is limited to documents that deal with patients. (In some cases, such as the HL7 Structured Product Labeling standard, non-patient-specific CDA-like specifications are created to get around this limitation.) FHIR documents have no limitation on their content and can have subjects other than patients.

**Human readability approach:** CDA and FHIR both require that content be human-readable and define specific rules for how the human readable text is presented.

**Clinical Statement vs. resources:** In CDA, the "content" of the document is expressed using a complex and extremely abstract model based on HL7's "Clinical Statement" project. Its purpose is to allow implementers to express pretty much any clinical concept in any degree of rigor and granularity. (In practice, there are limitations built into the CDA model that make the expression of certain clinical concepts challenging). This model provides significant power, but also presents challenges. The first is that RIM modeling expertise is required in order to express any particular piece of clinical information. It isn't obvious how to represent things like allergies or surgery or blood pressure "out of the box". Templates are required to support interoperability. The second is that common clinical concepts can be (and frequently are) modeled differently in different circumstances. With FHIR, all clinical (and non-clinical) content in a message is handled by referencing existing resource definitions. These resources make it clear how to represent common structures like allergies and blood pressure "out of the box" and ensure that there's only one way for core content to be represented. It does however create the limitation that an appropriate resource must have been defined in order to share content. In the early stages of FHIR development, it may be necessary to make use of the [Basic](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\basic.html) resource if an appropriate standard resource has not yet been defined.

**Templates and Profiles:** As discussed above, CDA relies on the presence of templates in order to understand the meaning of instances. (While the meaning can theoretically be determined by looking at RIM attributes and codes, the reality is that this is often not safe or sufficient. As such, pretty much every CDA instance includes *templateId* attribute values scattered throughout the instance to define meaning. With FHIR, meaning is defined by the resource. [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) can be used to define extensions, but they never refine the meaning of core elements. While the profiles used in constructing a particular instance can be declared within the instance via [tags](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#tag). However, such declaration is not required.

**Mark-up language:** CDA defines its own XML syntax for narrative content, loosely based on HTML. FHIR makes use of a constrained set of XHTML which is somewhat more expressive than the CDA markup. Conversions from FHIR to CDA will need to take these constraints into account (or alternatively provide a fully rendered version of the document).

### CDA Interoperability Considerations

CDA is a type of V3 specification. Therefore, all [considerations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v3.html#V3-interoperability) that apply to V3 messaging also apply to CDA. In addition, the following topics are specific to CDA implementations.

**What to map:** The right-hand side (clinical content) portion of the CDA model qualifies as an abstract model [as discussed above](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v3.html#V3-abstractModels). While the CDA header can reasonably be mapped to the HL7 [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) resource and related resources, mappings between FHIR and CDA should be done at the template level rather than the CDA specification itself.

**Human readable granularity:** With FHIR, narrative only exists for the resources at the root of each section. With CDA, narrative exists for each section. Usually this means the narrative in CDA and FHIR will correspond. However, in some cases, a section will contain other sub-sections. In CDA, these "container" sections can have narrative. In FHIR, they cannot. Applications will need to have some way of managing this if converting.

**Discrete to human-readable linkages:** To ensure semantic traceability, both FHIR and CDA allow establishing linkages between text in the narrative and specific discrete elements in the encoded part of a document. If converting between FHIR and CDA, these linkages need to be converted as well. However, this is complicated by the fact that the granularity at which linkages can occur is different between the two specifications. In CDA, linkages can only occur at the level of a section or one of a couple of the entry types. With FHIR, linkages can occur at any level at all, including individual data type components or even portions of extensions. Converting from CDA to FHIR will be straight-forward, however there will be information loss when converting the other way.

# comparison-other.html

## Other HL7 Standards

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

HL7 has produced a number of other standards that don't overlap with FHIR as closely as those listed above, primarily because they aren't focused solely on information exchange. However, they deserve a brief mention:

### EHR Functional Model (EHR-FM)

This specification defines a number of functional behaviors for Electronic Health Record systems. FHIR is a healthcare information exchange standard that can be used to satisfy some of these functional behaviors. Details on how FHIR fits into the EHR-FM can be found [here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ehr-fm.html)

### Context Management Specifications (CCOW)

CCOW is a standard for allowing independent systems to synchronize context on a single workstation, providing a seamless interface for the user of that workstation (e.g. ensuring consistent user authentication, display of the same patient, display of the same order, etc.) In theory, FHIR resources could be used as an alternative CCOW implementation technology, however the business case for doing this is not clear. CCOW profiles include V2 mappings. These mappings can be used to help identify the equivalent FHIR data elements when establishing CCOW linkages in FHIR-based systems.

### Arden Syntax

Arden Syntax is a language for defining decision support rules. These rules make reference to data elements that are used as part of the decision making process. However, the specification does not define how these data elements are identified. FHIR element and extension identifiers would provide one mechanism for identifying the relevant data elements.

### Virtual Medical Record

The Virtual Medical Record is a draft specification under development by HL7 that also serves the decision support space. It defines a logical medical record that decision support rules can be constructed against. At present, this model is a custom model created specifically for VMR. However, the Decision Support work group is evaluating the possibility of using FHIR as a structure for future versions of the specification.

# comparison-v2.html

## HL7 Version 2

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

HL7 version 2 (V2) was HL7's first information exchange standard and is one of its most widely adopted, being prominent in in-patient settings throughout the world, though also used in a variety of other contexts as well. HL7 V2 uses messages composed of re-useable segments to communicate healthcare-related information between a sending and receiving system as well as to invoke particular behavior (patient transfers, lab orders, etc.) It also supports one-way communication through notifications, provides support for queries and other workflow.

### V2 Similarities and Differences

**Event-based:** FHIR supports an event-based messaging paradigm similar to the V2 messaging structure (though unlike V2, FHIR supports other paradigms as well including documents, REST and other service models). Refer to the [Message Header](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource.

**Granularity:** HL7 V2's "Segment" structure provides re-useable chunks of data that roughly correspond to FHIR's idea of [resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html). However, V2 segments can't be independently manipulated. Additionally, not all segments have the characteristics of independent identity held by FHIR resources. Due to differences in scope and approach to extensibility, V2 segments and data types are frequently cluttered with data elements that are not used by (or even understood by) the majority of implementations

Segments can be composed into repeating and/or optional collections called "groups" to represent full healthcare business objects. For example, the "Order" component of an OMP (Pharmacy/Treatment Order Message) includes:

* an ORC segment dealing with workflow aspects of the order
* an RXO segment dealing with pharmacy-specific order aspects
* optional TQ1 and TQ2 segments describing the timing of the order
* optional NTE segments dealing with supplemental notes or rendering of the order
* optional RXR segments describing route information
* etc.

The V2 approach to granularity emphasizes re-use of "patterns" of information. For example, timing and route information are not useful on their own, but they are useful in many circumstances. Due to the 3-level nesting limit, separate segments are also required for data structures that would otherwise nest too deeply. FHIR takes a different approach to reusability, focusing on objects that can be maintained independently. The [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) resource encompasses all of the aspects of the above segments, with the exception of some of the workflow aspects of ORC which is handled by the [Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\order.html) resource. The [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) resource is itself complex, having nested structures for dosage instructions, dispensing instructions, etc. that are not simple data types.

**Extensibility:** HL7 V2 provides an extensibility mechanism through the use of "Z-segments". The meaning of these extensions is opaque without prior manual explanation by the sender. Extensions are supposed to be restricted to data elements that do not affect the meaning of the "standard" segments. FHIR [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html), on the other hand, can appear at any level (including within data types). [ModifierExtensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#modifierExtension) may be used to in circumstances where an extension can change the meaning of other elements (e.g. the introduction of a negation indicator on a record). Finally, the meaning of FHIR extensions is discoverable by resolving the URI that defines the extension. The URI approach also ensures that extensions created by independent systems won't collide. (This can be an issue with Z-segments.)

**Inter-version compatibility:** HL7 version 2 has strict processes for maintaining forward and backward compatibility. Content can only be added to the end of existing fields, components, etc. Applications are expected to ignore unexpected content or repetitions. FHIR promises similar compatibility rules. The path to an element within a FHIR instance will remain unchanged in future versions. Specific rules on handling "new" elements (ignoring, checking for "must understand" indicators, etc. will be developed during the DSTU period.

**Human readability:** In general, HL7 V2 instances do not provide for human readable versions of the content exchanged. While some systems may make use of NTE segments to provide a human-readable rendering of all or part of a message payload, the rules for when or if this occurs is site-specific. FHIR requires human readable content to be provided for each resource.

**Update behavior:** HL7 V2 data is typically exchanged in "snapshot" mode - updates are communicated by sending a complete copy of the instance with the new data filled in. However, some segments and messages in V2 support more sophisticated exchanges where only changed data is sent and codes or special values indicate what sort of change is to occur (e.g. add this address, remove this name). Out-of-the-box, FHIR only functions using snapshot mode. While the use of [ModifierExtensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#modifierExtension) to introduce equivalent behavior to V2 is possible, doing so would create interoperability issues and would make use of the resources difficult outside the messaging paradigm.

**Optionality & Profiles:** Both HL7 V2 and FHIR provide a similar degree of flexibility at the international standard level. Most data elements are optional. However, there are two differences. FHIR resources are much more limited in terms of what elements are included in the core specification - only those elements that the vast majority of systems will support. HL7 V2 tends to include many elements that are used in only very limited circumstances. FHIR uses extensions for those circumstances. V2 and FHIR both provide formal mechanisms for defining profiles to give guidance on the use of the specification. However, the V2 mechanism has not been widely used. FHIR [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) form an essential component of the methodology and are built into tooling, increasing the likelihood of their use.

### V2 Interoperability Considerations

**Mapping:** One of the biggest challenges with HL7 V2 interoperability is the variation of implementation. Even when identical scenarios are being handled in similar business environments, the data elements supported can vary and even the place where a given data element is placed in an instance can vary. As a result, defining consistent mapping rules between V2 and FHIR at an international or even regional level is not terribly realistic. The FHIR mappings provided give a starting point for consideration, but mappings will generally need to be done on an implementation by implementation basis.

**Extensions:** While some V2 elements will map to FHIR core, a large percentage will not. Where a V2 element is not supported by core, an extension will be needed to share the information. Where there is interest, HL7 may choose to publish and maintain extensions for V2 elements that are not supported as part of the core FHIR specification. The FHIR extension registry should be searched prior to defining local extensions. If time permits, the relevant HL7 WG should be contacted with a request to define additional V2 extensions if needed ones are not present. If time does not permit, applications can define their own extensions, but should have a migration plan for if/when HL7 defines it later. For Z-segments, URIs should be defined to be specific to the system/environment that defined the Z-segment (e.g. http://acme.org/fhir/extensions/consent), not based on the name of the Z-segment itself (given that Z-segments with the same name but different meaning may exist) (e.g. http://hl7.org/ZAC).

**Resource identification:** V2 messages will often reference objects that have already been referred to in previous messages. When converting the messages to FHIR, these references will need to point to the same resource URI. Given that not all V2 message objects have identifiers in the message, this can be somewhat problematic. An approach to handling this issue exists for FHIR [transactions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#transaction). However, the ramifications of using this approach in a messaging environment have not yet been resolved. Implementers will need to explore their own strategies as part of early adoption.

**Merging references and resources:** V2 message instances may well reference the same "object" numerous times. For example, a message containing a patient's medication history is likely to include references to the same clinicians and clinics/hospitals many times. While in some cases, the data captured for a given object might be identical in all uses, in other cases the information might vary. For example, the sending system might convey historical phone numbers for old records and current phone numbers for newer records. Alternatively, the message design might allow expression of different amounts of detail in different portions of the message or the sending application might simply be designed to convey different amounts of detail in different portions of the message (e.g. conveying phone number for an ordering clinician, but not for a data-entry clinician). When converting to FHIR, all references to the same "object" will generally have a single resource identifier and be referenced only once in the instance - with the complete set of information needed/available. This creates two challenges:

1. *How does the conversion software recognize when two portions of a message are referencing the same object?* While some references may have unique identifiers or names that are sufficient to confirm "same object", others may not - though some other combination of attributes may be sufficient. The specific rules will need to be determined by the implementer performing the conversion
2. *If multiple versions of data are present, what set of data should be used - or should multiple versions be sent with distinct history ids? (And if the latter, what is the 'order' of the versions?* If the order of the versions can be determined by data in the message (e.g. assuming older order dates have "older" demographics), dates can be specified on the entry *updated* element to indicate relative ordering. If the ordering can't be determined, it will be difficult to merge the data into a single resource or represent it using multiple resources.

**Identified vs. Contained resources:** Each HL7 V2 message will map to multiple resource instances - often 10s or even 100s of resource instances. To maintain consistency with the V2 messaging paradigm, all resource data will typically be sent over the wire as part of the FHIR message rather than being sent by reference as would be typical in a RESTful implementation. However, FHIR provides two different ways of communicating the resources as part of the message [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle): they can either be sent as "fully identified" resources (direct entries in the bundle with their own identity, and able to be the subject of independent transactions), or they can be sent as [contained](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#contained) resources, meaning they are only identified relative to another resources and cannot be retrieved or otherwise manipulated on their own. A V2 to FHIR conversion process will need to make the determination of what data elements are or must be present, for a resource to be fully identified. In some cases, the determination will be done at the time of mapping. In other cases, it may depend on the content of a particular instance. As an example, an XCN containing just a name (|^Smith^John|) doesn't contain enough information to identify the physician from any other John Smith, so will need to be contained resource, whereas an XCN of |12345^Smith^John| generally does, though the conversion process will need to be aware of the scope and management processes around the identifier.

**Generating human-readable content:** FHIR requires that every resource have a human readable [narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) that contains all information relevant to human decision-making. When converting from V2, developers (likely with guidance from clinicians) will need to determine what information from the message should be rendered and how to generate this content.

**Nulls and update modes:** In HL7 V2, "action" codes can determine whether particular segments represent information to be added, updated or deleted. Fields can be populated with "null" (two consecutive double-quotes with no other characters) to note a field is to be deleted. An omitted element or repetition is generally interpreted as "retain existing data unchanged". This contrasts with the FHIR approach of requiring all data to be present as a snapshot. Systems will either need to build in logic to generate a full snapshot of each resource or will need to introduce modifier extensions to allow similar behavior to V2.

# comparison-v3.html

## HL7 Version 3 (and ISO 21090)

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

HL7 Version 3 (V3) is the next generation of HL7's messaging standards. It introduced a common Reference Information Model (RIM), data type model and set of vocabulary as well as a formal standards development methodology. In addition, it introduced the use of "documents" as an alternative architecture to messaging for sharing healthcare information (see [the CDA comparison](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-cda.html)). While nominally covering both, the term "V3" is typically used to refer to "V3 messaging". The data types used as a basis for V3 have also been adopted by ISO as ISO 21090. The HL7 RIM has also been adopted as an ISO standard.

V3 messaging has been adopted by a number of large projects, particularly in the electronic health record area, though it has not achieved the market penetration of HL7 V2. The HL7 RIM and the ISO 21090 data types have also been used by other SDOs and projects that have not leveraged the full HL7 V3 methodology. Most of the comments and guidance provided here will apply to those solutions as well.

### V3 Similarities and Differences

**Reference model:** The use of the HL7 RIM is a core aspect of the HL7 V3 methodology and it is front and center in the specification and the wire format. All data elements in HL7 V3 instances are derived from either the RIM or the ISO data types. In FHIR, this is true of most resources and data type elements, but not all. Some resources ([StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html), [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html), [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html), etc.) deal with content that is outside the RIM's scope. And in a few circumstances, adjustments have been made in the FHIR data types that are not yet supported in the HL7 V3 data types model. The expectation is that these changes will be supported in the next version of the V3 data types model. The main difference is that the wire format of FHIR is not driven by the RIM mappings. This results in considerably more concise and intuitive instances. It is possible to implement FHIR with absolutely no knowledge of the HL7 RIM.

**Codes:** V3 places considerable reliance on coded attributes to convey the meaning of instances. Examples include *classCode*, *moodCode*, *determinerCode*, etc. The allowed codes for these attributes are strictly controlled by HL7. FHIR also has attributes that are limited to codes defined in the FHIR specification - those using the [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) data type. However, these are generally limited to attributes with business meaning - status, contact types, etc.

Both FHIR and V3 make use of value sets to define the sets of codes that can be used for attributes in particular contexts. However, in FHIR, a [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) is just another type of resource, meaning it can be sent as part of an instance just like any other piece of data. (The same is true of [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html), [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) and other meta-level resources.)

**Granularity & referencing:** HL7 V3 models are broken into 3 main types - wrappers, payloads and Common Message Element Types (CMETs). These are combined into interactions to define the set of content that can be sent over the wire at one time. In some cases, the granularity of each of these models will exactly align with the granularity of FHIR resources, but not always. V3 models are divided based on the expectation of re-use. FHIR models are divided based on whether the objects they represent are considered to be able to "stand alone". In HL7 V3, numerous models can exist to represent the same essential underlying healthcare information construct. For example, at the HL7 International level, there are 10 different CMETs for the concept of "Patient". In addition, some payload models represent patient directly without using CMETs. Further variation exists in the V3 models created by HL7 affiliates and other V3 implementers. Each of these different CMETs has their own schema and may use different element names, different levels of nesting and different constraints. With FHIR, there is only one [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource. Many profiles can be created on that resource, but all of them will use the same schema and support the same wire format.

**Design by constraint:** The design methodology in V3 is one of "design by constraint". The idea is that all data needed for any sort of healthcare communication is represented in the HL7 RIM. All other data models simply constrain the RIM to reflect the needs of particular domain spaces. This starts at the international level with further refinement happening in individual countries, projects and finally specific implementations. As models become closer to the implementer, they become less abstract. The result is a tendency for V3 models to be extremely broad in their coverage and capability and also somewhat abstract. They need to be in order to ensure that all possible implementations in the space covered by that model can be proper constraints on it. As well, each model produces its own schema and, in most cases, constrained schemas are not strictly wire-compatible with the schemas of the model being constrained.

FHIR takes a different approach. FHIR resources do not attempt to represent all data elements that could possibly be used in a space. Instead, only those data elements that are expected to be used by "most" implementations within the scope of the resource are considered part of the core resource definition. (This is sometimes referred to as "The 80% rule" - if approximately 80% of systems maintaining the resource will support the element, then it is part of core). All other data elements are expected to be handled using extensions. [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) are used both to constrain resources and to define extensions appropriate to narrower implementation spaces. Wire format interoperability is retained across all profiles on a given resource.

**Context conduction:** When conveying healthcare information between humans, much data can be inferred from context. For example, if a report has an "author" noted on a cover page, it is generally inferred that each statement within the report is authored by that same person. This inference grows more challenging when data needs to be analyzed by computers, whether for query, decision support or other analysis. Thus far, the HL7 V3 methodology has provided three distinct mechanisms to allow data models to define how "context" should propagate through models, making explicit for computers what humans would normally understand intuitively. FHIR has chosen a different path. In FHIR, no context is conducted - everything is explicit. If a report about a patient contains 100 observations all about that same patient, each observation will include a reference to the patient. However, this is relatively painless because it's only a reference - an id and possibly a short display value. One of the benefits of this approach is that each resource can be safely consumed and examined without concern for the context in which that resource was communicated. The meaning of each resource instance is fully self-contained.

**Null flavors:** In healthcare, it's quite common for data to be unknown, unavailable, have an exceptional value or otherwise fall outside the bounds of a "normal" value. To deal with this, V3 introduced the concept of "null flavor" on almost every attribute and data type property in its models. These coded null flavors could be sent in place of or in addition to the data that would typically be sent for the attribute, association or data type property. Examples include the ideas of "Unknown", "Not asked", "Positive infinity", "Trace amount", "Masked", "Other", etc. Unless an element was explicitly marked as "mandatory" - meaning no null flavors were permitted, these null flavors could appear absolutely anywhere.

FHIR approached the problem differently. Null flavors are only introduced in the core specification in those circumstances where it is expected that most systems will need them. Where needed, the flavors are constrained to those relevant to that element.

### V3 Interoperability Considerations

**Using RIM mappings:** Most resource elements and data type properties include mappings to the RIM. These mappings serve two purposes. They help to define FHIR semantics in terms of HL7's reference models, helping to ensure that the Work Groups defining the data elements have a good and consistent understanding of the meaning of every element. They also provide guidance for implementers of version 3 specifications that may be looking to migrate to or map between version 3 and FHIR. However, for the latter use it's important to understand some limitations on the RIM mappings. The RIM is a language which allows the same "idea" to be conveyed in a number of different ways with varying granularity and expressiveness. Thus it's entirely possible for a RIM element to map to a core FHIR element even though its RIM representation is somewhat different than described in the mapping. In addition, not all V3 models adhere to good modeling practices, so some data elements that would appear to map to a FHIR element might not map if the information has not been well represented. Therefore RIM mappings should be taken as a guide, not an absolute, and mappings must be done in the context of the V3 specification being mapped. (Also see [Abstract models](#V3-abstractModels) below.)

**V3 extensions:** While the core of the V3 methodology is "design by constraint", it still makes provision for the use of extensions - either in a foreign namespace or denoted by a special attribute. When converting between V3 and FHIR, the use of such extensions will need to be taken into account. As a rule, most V3 extensions will map to FHIR extensions, as the V3 design-by-constraint principle suggests that anything that would qualify as "core" in FHIR would already have been part of the base V3 specification.

**Abstract models:** As previously noted, many of the V3 models created at the HL7 International level are quite abstract. As a result, the models can be used to say a wide variety of things, often in a wide variety of different ways. This makes defining a mapping between those specifications and FHIR (or any other specification) quite tricky. For practical V3 <-> FHIR interoperability, mappings will need to be created at the level of message specifications, implementation guides and/or templates that are more concrete and closer to the implementation level. For example, mapping all of CDA to FHIR would be impossible given the expressive capability of the right-hand-side of the CDA model. However, mapping the Consolidated CDA (CCDA) templates to FHIR is quite possible.

**Context conduction:** As discussed above, HL7 V3 models rely on context conduction - either implicitly or explicitly controlled. When converting to FHIR, the context will need to be propagated into each resource.

**Update mode:** In HL7 V3 instances, updates are generally handled in snapshot mode, similar to the FHIR approach - if any information changes, the entire record is sent, including the modified data elements. However, the V3 methodology does support the introduction of an "updateMode" property to allow only the changes to be sent for all or part of an instance. Each element repetition is flagged with an updateMode to indicate whether the element is to be added, removed, updated, etc. Additional updateModes allow further control over updates. As with the [V2 discussion](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-updateMode) above, implementers will need to generate a full snapshot of each resource or will need to introduce modifier extensions to allow similar behavior to V3.

**Additional considerations:** Most of the implementation considerations for interoperating between FHIR and V2 also hold with V3. Specifically: [Extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-extensions), [Independent vs. Contained resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-contained), [Resource Identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-identification), [Merging references and resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-merging) and [Generating human-readable content](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html#V2-humanReadable).

# comparison.html

## Appendix: The Relationship between FHIR and other HL7 Standards

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

[Health Level Seven (HL7)](http://www.hl7.org) has been developing healthcare information exchange and related standards since 1987. In that time, the organization has produced a number of standards families - many used throughout the world to automate healthcare data sharing and improve patient care. FHIR has been written to be implementable without any knowledge of these other specifications. However, FHIR does leverage this prior experience, both in terms of applying best practices learned from experience and attempting to avoid some of the pitfalls of earlier work.

This appendix describes the relationship of FHIR to some of HL7's other standard families. It may be of interest to those coming to FHIR with previous experience with other HL7 standards as well as those who may need to support interoperability between FHIR solutions and implementations of other HL7 standards.

In this appendix:

* [Version 2.x](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html)
* [V3 (RIM / messaging)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v3.html)
* [CDA & CCDA etc](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-cda.html)
* [Other HL7 standards](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-other.html)

**Notes:**

* In addition to the major standards families identified below, HL7 produces numerous implementation guides, some of which have earned as much prominence as a standard family themselves. The general guidance given below for each standard family should hold for all implementation guides based on that standard. For example, the guidance listed for [CDA](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-cda.html) would apply to Consolidated CDA (CCDA) and other CDA Implementation Guides.
* While this appendix focuses on the relationship between FHIR and other HL7 standards, relationships also exist to non-HL7 standards. Some resources provide direct implementation of functionality from other standards including [DICOM](http://medical.nema.org) (see the [ImagingStudy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingstudy.html) resource) and [IHE](http://www.ihe.net/) (e.g. the [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) and [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) resources).
* Many FHIR resources draw requirements from or provide mappings to other standards. Some resources also provide additional guidance on how to use them with external specifications as part of their implementation notes. As well, a wiki page to capture additional guidance on the use of FHIR with other specifications can be found [here](http://wiki.hl7.org/index.php?title=FHIR_and_Other_Specifications)
* FHIR can satisfy the needs covered by all of the previous primary HL7 interoperability standards (V2, V3 and CDA). In many cases, it also provides additional benefits in terms of ease of interoperability. Therefore, the possibility exists that FHIR could gradually replace some or all of these standards. However it is unclear how rapidly (or even if) the market will make such a migration. It is likely that most of these standards will exist in parallel for quite some time. HL7 has committed to ongoing maintenance of existing standards for as long as the HL7 membership requires.

# compartments.html

## Compartment Based Access

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 3 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Compartments

Each resource may belong to one or more logical compartments. A compartment is a logical grouping of resources which share a common property. Compartments have two principal roles:

* Function as an access mechanism for finding a set of related resources quickly
* Provide a definitional basis for applying access control to resources quickly

Compartment definitions describe how particular compartment instances are named and identified, and how systems know which resources are in the compartment. The following compartments are defined by this specification:

Compartments are defined and added the list above when implementer communities identify them as common access points for data. As described below, compartments have both syntactical and logical consequences, and both these aspects of their functionality are evaluated when deciding whether to define compartments.

### Using Compartments

As an example of compartment usage, to retrieve a list of a patient's conditions, use the URL:

GET [base]/Patient/[id]/Condition

Additional search parameters can be defined, such as this hypothetical search for acute conditions:

GET [base]/Patient/[id]/Condition?code:in=http://hspc.org/ValueSet/acute-concerns

Note that as searches, these are syntactic variations on these two search URLs respectively:

GET [base]/Condition?patient=[id]

GET [base]/Condition?patient=[id]&code:in=http://hspc.org/ValueSet/acute-concerns

However, there is a key difference in functionality between compartment based searches and direct searches with parameters. Consider this search:

GET [base]/Patient/[id]/Communication

Because the definition of the [patient compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartment-patient.html) for [Commnunication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\communication.html) says that aCommunication resource is in the patient compartment if the subject, sender, or recipient is the patient, the compartment search is actually the same as the union of these 3 searches:

GET [base]/Condition?subject=[id]

GET [base]/Condition?sender=[id]

GET [base]/Condition?recipient=[id]

There is no way to do this as a single search, except by using the [\_filter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search_filter.html):

GET [base]/Condition?\_filter=subject re [id] or sender re [id] or recipient re [id]

Further details of searching by compartment are [described under the search operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#vsearch). As a search related operation, the assignment of resources to compartments is only based on the current version of any of the resources involved. Note that [contained](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#contained) patient resources cannot create a patient compartment of their own.

Compartments may be used explicitly, like this, but can also be used implicitly. For instance, if a FHIR server is providing a patient view of a record, the authorized user associated with use of the FHIR RESTful API may be limited to accessing records from the compartment instance(s) logically associated with their identity. Irrespective of whether compartments are being used explicitly or implicitly, servers will need to make arrangements to make some resources with no direct link to a patient available to the client (medications, substances, etc.).

Note that resources may cross between compartments, or interlink them. Examples of this would be where a [Diagnostic Report](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) identifies a subject, but an [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) it references identifies a different subject, or where a [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html) resource references items that identify different subjects. Such cross-linking may arise for many valid reasons, including:

* Cases where subject records are inter-linked - Transplants, Perinatal care, family therapy etc.
* Workflow management where action lists link multiple patients and/or practitioners

Given the wide variety of use cases and contexts in which FHIR is used, compartments do not define how cross-linking is handled. Systems may reject resources, remove them from both compartments, or place them in both, or act in some other fashion.

It is at the discretion of the server whether to include resources in a compartment when the reference to the resource that establishes the compartment is in an extension.

Some resources are not in any compartment, e.g. [Medication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication.html), [Substance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\substance.html), [Location](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\location.html). These resources are not directly to a patient or authored record, and are some times called 'master files'. Servers will need to make arrangements to make these resources available to the clients that are limited to particular compartments. For example, a Medication resource describes a medication itself and does not link to a patient; however, a resource such as MedicationAdministration connects the Medication (details of what was administered) to the patient (for whom was it administered), and so is required to interpret the administration.

# compatibility.html

## Inter-version Compatibility

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The following rules will apply to resources, profiles and other content within the specification once those portions of the specification reach [full normative status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html#normative). These rules ensure that implementations may exercise FHIR interfaces and process the content of FHIR resources safely while exchanging data between applications using different versions of FHIR.

During the period of trial use of the specification (and once normative status is reached for elements that remain at draft or trial use status), changes may occur based on issues identified during early implementation of the specification. These changes do not need to adhere to the rules listed below.

### Version identification

There is no explicit version marker in the resource content. FHIR adheres to the DICOM approach to versioning where content can safely be processed by instances independent of version. When dealing with DSTU-level content, applications may wish to use [resource tags](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#tags) to help manage this during the period of trial use.

The conformance layer ([Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) and [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html)) has mandatory properties declaring the FHIR specification version, and these may be used to determine which version of FHIR an implementation is using to aid in validation.

### Change frequency

New versions of the FHIR specification will be produced regularly in accordance with the [FHIR publication timeline](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html). New versions of the specification will include additional draft and trial use content as well as promotion of previous trial use content to normative. Once content reaches normative, changes are expected to be infrequent. This is for two reasons:

1. The core specification focuses on those capabilities expected to be supported by most systems. For new capabilities to be introduced, it would need to be reflective of an overall change in the world-wide healthcare implementation environment.
2. If the implementation community has already consolidated around a standard approach to solving a FHIR implementation issue (e.g. using a particular extension), FHIR will not introduce confusion into the implementation community by defining a conflicting mechanism for solving that problem in the core specification.

### Forward compatible behavior

In a typical scenario, mixed versions may need to exist, so applications SHOULD ignore elements that they do not recognize unless they are modifierExtensions. However, in a healthcare context, many application vendors are unwilling to consider this approach because of concerns about clinical risk or technical limitations in their software (e.g. schema based processing). Applications are not required to ignore unknown elements, but SHALL declare whether they will do so in their [conformance statements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html).

Unrecognized search criteria SHALL always be ignored. (Search criteria supported in a query are echoed as part of the search response so there is no risk in ignoring unexpected search criteria.)

Attempts to perform HTTP operations on unexpected URLs SHOULD be responded to with an appropriate error code.

### Permitted changes for normative content

|  |  |
| --- | --- |
| **Category** | **Allowed changes** |
| Elements | Once normative, subsequent versions of this specification may introduce new elements and/or content (e.g. XML attributes, etc.) at any point in the bundle, resource and/or data type structures. However, the names, path and meaning of previously existing data elements will not be changed. This includes no change to resource names and no changes to names assigned to slices and other elements within profiles. |
| Cardinality | Minimum element cardinalities will not be changed. Upper cardinality may change from 1 to \* only in circumstances where all elements except for the first repetition can be safely ignored. (This may mean that an order is assigned to the repeating items or that there is no preference as to which element is retained.) Systems should follow the rules above for unexpected elements. |
| Descriptions | Descriptive information about a resource - short labels, definitions, usage notes, aliases, examples, rationale, mappings, etc. may be updated or revised to provide additional clarity or guidance, but not in such a manner as to invalidate a reasonable interpretation of the previously documented use of an element. (This does not preclude fixing obvious errors.) |
| Value Sets | The definition of any value set that is marked as "immutable" will never change. The expansions for immutable value sets may still change if no "stable date" is declared and the value set does not restrict code system and/or value set references to specific versions if the referenced code system(s) or value set(s) change.  For non-immutable value sets:   * Value sets with an enumerated list of codes and having a 'fixed' binding may have additional codes introduced but will never have codes removed, thought they may be deprecated. * Value sets making use of filters may have filters loosened or tightened to accommodate changes to underlying code systems. StableDates and referenced code system and value set versions may be adjusted to point to newer versions. * Definitions and display values for codes may change, but only in a manner that would not change the reasonable interpretation of data captured using the previous definitions or names. * Abstract codes may be made concrete. Concrete codes will not be made abstract.   For both immutable and non-immutable value sets, additional designations may be declared. |
| Terminology Bindings | Fixed bindings will remain fixed and will continue to point to the same value set. If the reference is version-specific, it will not change. Example bindings and Incomplete bindings may change to point to distinct value sets. Example bindings may be replaced with Incomplete bindings. |
| Data Types | Data types will not be removed or changed. New data types may be introduced. Types declared on existing elements will not be removed or changed. Additional data types may be added to elements which are already expressed as a choice of data types only if those elements are optional (minimum cardinality = 0). |
| Value Constraints | The allowed list of Data types will not be added, removed or changed. Invariants, regular expressions, fixed values and patterns will not be added, removed or changed. |
| Flags | The *Is Modifier* and *Is Summary* flags will not be changed. The *Must Support* flag may be changed to true, but will not be removed. |
| Slicing | Slicing rules and aggregation characteristics will not be changed. |
| Search Criteria | Search criteria may be added but not removed or renamed. Existing criteria will not have their type or path changed or have their description altered in any way that would invalidate the reasonable behavior of existing systems (with the exception of correcting obvious errors). |
| Operations | New operations may be defined but operations may not be removed or renamed. Existing parameters will not be removed or renamed, nor may their type or lower cardinality be changed. Upper cardinality may be changed from 1 to \*. (Systems should ignore unexpected repetitions.) Additional optional parameters may be introduced. E.g. Operation signatures cannot change, instead, additional operation variants will be defined. |
| Restful interface | Existing endpoints will not be renamed or removed, nor have their expected behavior changed in a manner that would cause reasonable systems designed against prior versions to be non-interoperable. Additional endpoints may be introduced. |
| Profiles and extension definitions | Profile structure, extension definitions and search criteria definitions will not be removed or have their URIs changed. New profile structures, extension definitions and search criteria definitions may be introduced. Profiles may have their statuses changed to "retired". Profiles referenced by data elements for structures or data types may be replaced with a reference to a distinct profile that is "compatible" with the previously referenced profile according to these forward and backward compatibility rules. |

Additional discussion on inter-versioning issues can be found here: <http://wiki.hl7.org/index.php?title=FHIR_interversion_compatibility>.

# conformance-rules.html

## Conformance

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The FHIR specification describes a set of [resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html), and several different frameworks for exchanging resources between different systems. Because of its general nature and wide applicability, the rules made in this specification are generally fairly loose. As a consequence, this specification allows that different applications may not be able to be interoperate because of how they use optional features. As a consequence, applications claiming conformance to this specification make the claim in respect of a specific exchange framework, and in regard to a specific details about their usage of those frameworks and resource contents.

Application claim conformance to one (or more) of the following exchange framworks:

* "RESTful FHIR": the [RESTful api](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html)
* "FHIR messaging": [message based exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html)
* "FHIR documents": [document based exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html)

To provide details about specific usage of the frameworks and resource contents, FHIR provides a [conformance layer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) that implementers and national/regional programs can use to provide a computable statement about how the resources and their exchange paradigms are used to solve particular use cases. The conformance layer itself is implemented using the following key resources:

|  |  |
| --- | --- |
| [Value Set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) | Defines a set of coded values (see "[Using Codes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html)" for more details) |
| [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) | Makes rules about how a resource (or type) and its data elements are used in a particular context. A structure definition references value sets for the coded elements in a resource |
| [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) | A statement of the kinds of resources and operations provided and/or consumed by an application. The conformance resource references profiles to describe specific use of resources by the application |
| [Implementation Guide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementationguide.html) | A single coherent collection of conformance statements, profiles, value set, and documentation describing a set of interoperable applications |

The specification also [provides a number of tools that can assist with enforcing technical conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation.html) to this base specification and profiles on it.

Conformance with this specification does not provide any guarantee of patient or data safety. However, choosing to not conform to this specification carries additional risk in two ways:

* FHIR has been subject to a level of review and vetting unlikely to be received by any non-conformant variation; variations may result in introduction of undetected risks
* FHIR-like solutions (based on FHIR, but not conformant) may set expectations by trading partners which are not met due to the non-conformance of the system and these un-met expectations may also result in risk

### Base Conformance Rules

The contents of a resource and the formats used to represent resources SHALL conform to the rules described in this specification, as defined in the narrative of the specification, and as controlled by the conformance properties defined below.

Note: This specification uses the conformance verbs SHALL, SHOULD, and MAY as defined in [RFC 2119](http://www.ietf.org/rfc/rfc2119.txt). Unlike RFC 2119, however, this specification allows that different applications may not be able to be interoperate because of how they use optional features.

Data elements defined in resources and data types have 3 properties that are directly related to conformance: Cardinality, Is-Modifier, and Must-Support. These interact to place conformance requirements on implementations.

### Cardinality

All attributes defined in FHIR have cardinality as part of their definition - a minimum number of required appearances and a maximum number. These numbers specify the number of times the attribute may appear in any instance of the resource type. This specification only defines the following cardinalities: 0..1, 0..\*, 1..1, and 1..\*. Profiles that describe specific use cases may use other values for cardinality within the limits of the cardinality defined by the base resource.

Note that when present, elements cannot be empty - they SHALL have a value attribute, child elements, or extensions. This means that setting an element to a minimum cardinality of 1 does not ensure that valid data will be present; specific XPath constraints are required to ensure that the required data will be present.

In this specification, very few elements have a minimum cardinality of 1. Resources are used in many contexts, often quite removed from their primary use case, and sometimes even basic information is quite incomplete. For this reason, the only elements that have a minimum cardinality of 1 are those where they are necessary to any understanding of the resource or element that contains them. The minimum cardinalities should not be taken as a guide to what elements are expected to be present in any particular use of the resource, including their normal/primary usage purpose. In some cases, this specification publishes additional profiles that define which elements are required in particular situations. Similar profiles are published by jurisdictions, vendors, or projects.

For elements that have cardinality > 1, the order in which they appear may have meaning. Unless the element definition (either in this specification or the extension) defines a meaning to the order explicitly, the meaning of the order is not defined, and implementations are allowed to reorder the elements. Note that it is not possible to define a meaning for the order of the elements in a [profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) using a [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html). When there is no definition of the meaning of the order, implementations that need to choose a single element from a list of elements for some use SHALL do so based on the semantics of the content of the elements that repeats. Profiles and Implementation guides may often make rules about this selection process.

### Is-modifier

Is-Modifier is a boolean property that is assigned when an element is defined, either as part of the base resource contents in this specification, or when [extensions are defined](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html). An element is labeled "Is-Modifier = true" if the value it contains may change the interpretation of the element that contains it (including if the element is the resource as a whole). Typical examples of elements that are labeled "Is-Modifier" are elements such as "status", "active", "refuted", or "certainty". Whether an element is a modifier cannot be changed when element usage is described in a profile (i.e. a constraining [Structure Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html)). When an element is labeled as Is-Modifier, the documentation must be clear about why it is a modifier.

A typical example of a modifier element is one that negates the element that contains it. For instance, in the following fragment of a resource definition:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**Name**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Flags**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Card.**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Type**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Description & Constraints**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) |
| [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance-definitions.html#AllergyIntolerance) |  |  | [DomainResource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\domainresource.html) | Allergy or Intolerance (generally: Risk Of Adverse reaction to a substance) |
| [onset](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance-definitions.html#AllergyIntolerance.onset) | Î£ | 0..1 | [dateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime) | Date(/time) when manifestations showed |
| [patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance-definitions.html#AllergyIntolerance.patient) | Î£ | 1..1 | [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html)([Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html)) | Who the sensitivity is for |
| [status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance-definitions.html#AllergyIntolerance.status) | ?! Î£ | 0..1 | [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) | active | unconfirmed | confirmed | inactive | resolved | refuted | entered-in-error [AllergyIntoleranceStatus](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-allergy-intolerance-status.html) ([Required](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#required)) |
| [criticality](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance-definitions.html#AllergyIntolerance.criticality) | Î£ | 0..1 | [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) | CRITL | CRITH | CRITU [AllergyIntoleranceCriticality](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-allergy-intolerance-criticality.html) ([Required](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#required)) |

The element "didNotOccurFlag" affects the entire meaning of the resource - if it is set to true, the whole resource must be understood differently, and so it is not safe for implementations to ignore it. As a consequence, it is labelled as 'is modifier = true'. In this tabular representation of the resource, this shows as the flag '?!'. The [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html) and [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) representations of a resource definition have their own representation of 'is modifier = true' status, and it is defined directly in a [ElementDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-definitions.html#ElementDefinition.isModifier).

Is-Modifier elements SHALL be represented in the narrative summary of the resource.

If the value of a modifier element is not explicit in the instance, or known by the context, the resource may not be able to be safely understood. Wherever possible, elements labeled "Is-Modifier = true" also have a minimum cardinality of 1, or a default value, in order to introduce certainty in their handling. However sometimes this is not possible - much legacy data is not well described. Iimplementations producing resources SHOULD ensure that appropriate values for isModifier elements are provided at all times.

Implementations processing the data in resources SHALL understand the impact of the element when using the data. Implementations are not required to "support" the element in any meaningful way - they may achieve this understanding by rejecting instances that contain values outside those they support (for instance, an application may refuse to accept observations with a reliability other than "ok"). Alternatively, implementations may be able to be sure that, due to their implementation environment, such values will never occur. However applications SHOULD always check the value irrespective of this.

Note that processing the data of a resource typically means copying or filtering data out of a resource for use in another context (display to a human, decision support, exchange in another format where not all information is included, or storing it for this kind of use). Servers and background processes that simply move whole resources around unchanged are not "processing the data of the resource", and therefore these applications are not required to check Is-Modifier elements.

Every element in the base resource has a value of "true" or "false" for the Is-Modifier flag. The value of the flag cannot be changed by profiles on the resource, in either direction. When a profile defines an extension, it labels the extension with the Is-Modifier flag, and this cannot be changed in other profiles. Note that extensions that have is-Modifier = true are represented differently in resource instances ("modifierExtension" instead of "extension"), and there are [additional rules about how they are handled](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#modifierExtension).

### Must-Support

Labeling an element Must-Support means that implementations that produce or consume resources SHALL provide "support" for the element in some meaningful way. Exactly what this means is impossible to describe or clarify as part of the FHIR specification.

For this reason, the specification itself never labels any elements as must-support. This is done in [Resource Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#mustsupport), where the profile labels an element as mustSupport=true. When a profile does this, it SHALL also make clear exactly what kind of "support" is required, as this can mean many things.

Note that an element that has the property IsModifier is not necessarily a "key" element (e.g. one of the important elements to make use of the resource), nor is it automatically mustSupport - however both of these things are more likely to be true for IsModifier elements than for other elements.

### Constraints

All elements may have constraints attached to them (also known as 'invariants'). Constraints defined on an element have the following properties:

|  |  |
| --- | --- |
| **Key** | Identifies the constraint uniquely amongst all the constraints in the context - typically, this is used to refer to the constraint in an error message |
| **Requirements** | An explanation of why the constraint has been applied - what harmful conditions are being avoided |
| **Severity** | Whether the constraint is an error, or a warning. The exact difference in meaning of these depends on context, but an error is associated with "SHALL" and systems rejecting content, where as a warning might not be |
| **Human Description** | A human description of the rule intended to be show as the explanation for a message when the constraint is not met |
| **XPath Expression** | An XPath expression taht must evaluate to true when run on the element in the XML representation. To use the constraint in JSON, the resource must be converted to XML |

**DSTU Note:** Alternatives to XPath are being sought. Not only are XPath expressions XML specific, but the expressions defined in the specification require XSLT2, which is not well supported. The ideal solution will apply to either XML or JSON, and be widely supported in off the shelf tools.

Feedback is welcome [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

Many constraints are defined in the base specification. In addition, additional constraints may be defined in [profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) that apply to resources. Systems are not required to evaluate the constraints, just as they are not required to check for conformance, or schema validatity. However, systems SHOULD alway ensure that all resources are valid against all applicable constraints.

Elements can also be explicitly associated with constraints defined elsewhere. This is a notification to implementers that the element is affected by the constraint. It has no meaning when the constraints are evaluated.

[Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) may define additional constraints that apply to an element, but they cannot alter or remove constraints that are already applied.

### Other Metadata

In addition to the conformance, metadata, each element has other metadata properties:

* **isSummary** - How the element behaves in [Summary Searches](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#summary)
* **defaultValue / meaningWhenMissing** - What it [means when an element is missing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html#missing)
* **maxLength** - How long the representation of the primitive value is allowed to be (not including XML or JSON escaping)

### Examples and Reference Implementations

This specification includes many examples. While every effort has been made to ensure that the examples are fully conformant to the specification, if the examples disagree with the specification, the specification is considered correct and normative, not the examples. This same rule applies to the reference implementations.

The examples reflected in this specification do \*not\* represent actual people. Any resemblance to real people - alive or dead - is entirely coincidental. In some cases, examples may be drawn from real clinical data. However, if this has occurred, the content has been scrubbed to remove any identifying information.

# cpt.html

## Using CPT with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | CPT is made managed by the [American Medical Association](http://www.ama-assn.org/ama) |
| System | The URI <http://www.ama-assn.org/go/cpt> identifies the CPT code system |
| Version | Where a version is appropriate, use the year of release e.g. 2014 |
| Code | "Code" in the CPT tables (a 5 character code) |
| Display | "Description" in the CPT tables |
| Filter Properties | None defined |

### Version Issues

CPT is released each October. CPT versions are identified simply by the year of their release.

### Example Usage

<coding>

<system value="http://www.ama-assn.org/go/cpt"/>

<version value="2014"/>

<code value="31502"/>

<display value="Tracheotomy tube change prior to establishment of fistula tract"/>

</coding>

### Copyright/License Issues

CPT is a registered trademark of the American Medical Association. The AMA holds the copyright for the CPT coding system.

When Value Sets include CPT codes, the copyright element should include the text "CPT copyright 2014 American Medical Association. All rights reserved.".

### CPT Filter Properties

No filter properties have been defined at this time.

### Implicit Value Sets

The value set URL http://hl7.org/fhir/ValueSet/cpt-all is a value set that includes all CPT codes.

# credits.html

## Community and Credits

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Community

The FHIR community meets inside the wider [HL7 community](http://hl7.org) and draws on its extensive human resources, institutional memory, previous standards and corporate support. HL7 itself owns FHIR and makes it freely available and the community relies on HL7 provided infrastructure.

The primary resources used by the FHIR community are the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR), and the [FHIR email list](http://wiki.hl7.org/index.php?title=FHIR_email_list_subscription_instructions). In addition, the community holds regular face to face meetings as part of the [HL7 Working Group meetings](http://www.hl7.org/events/workgroupmeetings.cfm?ref=nav). The formal governance arrangements that manage FHIR development are documented on HL7's [wiki](http://wiki.hl7.org/index.php?title=FHIR_Governance_Process)

### Credits

FHIR is a specification produced by the HL7 Community. Many individuals contribute to the FHIR specification. Of particular note:

* The Editorial team is Grahame Grieve (Health Intersections), Ewout Kramer (Furore), Lloyd McKenzie (Gevity) and Josh Mandel (Harvard)
* The [Governance board](http://wiki.hl7.org/index.php?title=FHIR_Governance_Board) is Woody Beeler, Lorraine Constable, Grahame Grieve, Ewout Kramer, John Quinn and Dave Shaver
* The [Management board](http://wiki.hl7.org/index.php?title=FHIR_Management_Group) is David Hay, Paul Knapp, Josh Mandel, Lloyd McKenzie, John Moehrke, Brian Pech, Brian Postlethwaite, John Quinn and Ron Parker. (Former members: Lorraine Constable, Jean Duteau and Hugh Glover)
* The basic HTML design done by [studiojoyo.com](http://www.studiojoyo.com/) - thanks
* The following organizations have helped by attending Connectathons: [Accenture](http://www.accenture.com), [AEGIS.net Inc](http://www.aegis.net), [Agfa Healthcare](http://www.agfahealthcare.com), [American Immunization Registry Association](http://www.immregistries.org), [American Society of Clinical Oncology](http://www.asco.org), Apertura, [Blue Wave Informatics](http://www.bluewaveinformatics.co.uk), [Boston Children's Hospital](http://www.childrenshospital.org/), [BRIT Systems](http://www.brit.com), [Cambia Health Solutions](http://www.cambiahealth.com), [Canada Health Infoway (CHI)](http://infoway-inforoute.ca), [Center for Medical Interoperability](http://medicalinteroperability.org), [Centers for Disease Control and Prevention](http://www.cdc.gov), [Choice Hospital Systems](http://www.choise-hs.com), [Cognitive medical Systems](http://www.cognitivemedicalsystems.com), [College of American Pathologists](http://www.cap.org/), [Corepoint Health](http://www.corepointhealth.com), [CSIRO ICT](http://www.ict.csiro.au), [DCA Health Solutions](http://ehealth.data.com.au), [Deontik Pty Ltd](http://deontik.com), [DIPS](http://www.dips.no), [Dynamic Health It](http://www.dynamichealthit.com), [ecGroup Inc](http://ecgroupinc.com), Ediden Group Inc., [Edmond Scientific Company](http://www.edmondsci.com), [Epic](http://www.epic.com), [GE Healthcare](http://ge.com), [Fujifilm Australia](http://www.fujifilm.com.au), [Furore](http://furore.com), [Gea-Interactive](http://2013.gea-interactive.com.au), [Global Village Consulting](http://global-village.net), [Gevity](http://www.gevityinc.com), [Health Intersections](http://www.healthintersections.com.au), [Health IQ](http://www.healthiq.com.au), [Healthcentrix](http://www.healthcentrix.com), HealthFire, Healthwise, [Helse Vest IKT AS](http://www.helse-vest-ikt.no), [HL7 Argentina](http://www.hl7argentina.org.ar), [HL7 New Zealand](http://www.hl7.org.nz), [HL7 UK](http://www.hl7.org.uk), [Icahn School of Medicine at Mount Sinai](http://icahn.mssm.edu), IHIS Research Center, Kyungpook National University, [Intelligent Medical Objects (IMO)](https://www.e-imo.com), [Interfaceware](http://www.interfaceware.com), [Inovalon](http://www.inovalon.com), [Intermountain Healthcare](http://www.intermountainhealthcare.org), [J P Systems](http://www.jpsys.com), [Kestral Computing](http://www.kestral.com.au), Knapp Consulting Inc., [Lantana Consulting Group](http://lantanagroup.com), [The Lazy Company](http://thelazycompany.com), [Mater Pathology](http://pathology.mater.org.au), [Mayo Clinic](http://mayoclinic.org), [McKesson](http://www.mckesson.com/), [Mohawk College](http://www.mohawkcollege.ca/), [MSIA Australia](http://www.msia.com.au), [National E-Health Transition Authority (NEHTA)](http://www.nehta.gov.au), [National Institute of Standards and Technology (NIST)](http://www.nist.gov), [NProgram](http://www.nprogram.co.uk/), [Office of the National Coordinator for Health Intormation Technology](http://www.healthit.gov/), [Open Mapping Software](http://www.openmapsw.com/), [Oridashi](http://oridashi.com.au), [Orion Healthcare](http://www.orionhealth.com), [Qvera](http://www.qvera.com), [Queensland Health](http://www.health.qld.gov.au), [Regenstrief Institute](http://www.regenstrief.org), [RelayHealth](http://www.relayhealth.com), [Ringholm](http://www.ringholm.comâ€Ž), [Roche Diagnostics International Ltd.](http://www.roche-diagnostics.comâ€Ž), [Smart Health Solutions](http://www.smarthealth.com.au), [Smart Platforms](https://smartplatforms.org), [Sysmex AU](http://www.sysmex.com.au), [Sysmex NZ Ltd](http://www.sysmex.co.nz), [Systems Made Simple](http://www.systemsmadesimple.com), [Thrasys](http://www.thrasys.com/), [U.S. Dept. of Veteran Affairs](http://www.va.gov), [University Health Network](http://www.uhn.ca), [Vanderbilt University Medical Center](http://www.mc.vanderbilt.edu), Vermonster, [Web MD Health Services](https://www.webmdhealthservices.com/), [West Health](http://www.westhealth.org), [yConsult](http://yconsult.com.au), [YouCentric](http://www.youcentric.com) and [Zynx Health](http://www.zynxhealth.com)
* The FHIR specification includes content developed by or reviewed by the following [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm): Clinical Genomics (CG), Clinical Quality Information (CQI) Conformance & Guidance for Implementation/Testing (CGIT), Community Based Collaborative Care (CBCC), Electronic Health Record (EHR), Financial Management (FM), Health Care Device (Devices), Imaging Integration (II), Implementable Technology Specifications (ITS), Infrastructure & Messaging (InM), Modeling & Methodology (MnM), Orders & Observations (OO), Patient Administration (PA), Patient Care (PC), Pharmacy, Public Health & Emergency Response (PHER), Security, Structured Documents (SD), Templates and Vocabulary
* In addition, some resources were developed in coordination with the following organizations: [DICOM](http://medical.nema.org/standard.html) and [IHE](http://http://www.ihe.net)
* The following individuals were development leads or primary content contributors for resource development: Lorraine Constable, Hugh Glover, Grahame Grieve, Alexander Henket, Paul Knapp, Ewout Kramer, Patrick Loyd, Joginder Madra and Lloyd McKenzie
* Invaluable support through review of ballots and/or participation in FHIR formal QA processes was provided by: Tomasz Adamusiak, Yongjian Bao, Calvin Beebe, Woody Beeler, Ruth Berge, Bernd Blobel, Andy Bond, Keith Boone, Laura Bright, Victor Chai, Dennis Cheung, Kathleen Connor, Teresa Conway, Todd Cooper, Carmela Couderc, Jean Duteau, Gary Dickinson, Guilherme Del Fiol, Savithri Devaraj, Bob Dollin, Michael Ekaireb, Sergio Enriquez, Rick Geimer, William Goosen, Grahame Grieve, Eric Haas, David Hay, Yan Heras, Russel Hamm, Rob Hausam, Mike Henderson, Yan Heras, Rob Horn, Anthony Julian, Paul Knapp, Richard Kavanagh, Helmut Koenig, Ewout Kramer, Eric Larson, Khalid Latif, Michael Lawley, Ben Levy, Stefano Lotti, Patrick Loyd, Josh Mandel, Clem McDonald, Lloyd McKenzie, Riki Merrick, Zoran Milosevic, John Moehrke, Saurabh Moudgil, Claude Nanjo, Dale Nelson, Shamil Nizamov, Brian Pech, Vasil Peytchev, Bas van Poppel, Dave Pyke, Gila Pyke, Stan Rankins, Gordy Raup, Dianne Reeves, Greg Rehwoldt, Mitra Rocca, Michael Rossman, Iryna Roy, Brian Scheller, Amnon Shabo, Rik Smithies, Harry Solomon, Andy Stechishin, Sylvia Thun, Michael van der Zel, Mead Walker, Kathy Walsh and Ian Williams

# cvx.html

## Using CVX (Vaccine Administered) with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | Available at <http://www2a.cdc.gov/vaccines/iis/iisstandards/vaccines.asp?rpt=cvx>. Developed by The CDC's National Center of Immunization and Respiratory Diseases ([NCIRD](http://www.cdc.gov/ncird/)) |
| System | The URI to identify CVX codes is http://hl7.org/fhir/sid/cvx |
| Version | If it is desired to exchange the version, use the date of the last updated code in the format YYYYMMDD |
| Code | Use the value of "CVX Code" column in the web page |
| Display | Use the value of the "Short Description" column in the web page |
| Filter Properties | None are described yet |

### Version Issues

If it is desired to exchange the version, use the date of the last updated code in the format YYYYMMDD.

### Copyright/License Issues

CVX has no copyright acknowledgement needed, nor are there any license terms to adhere to.

### CVX Filter Properties

No need for filters identified yet.

### Implicit Value Sets

No need for implicit value sets identified yet.

# datatypes-definitions.html

## Data Type Detailed Descriptions

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page provides the detailed descriptions for the data types

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| **Primitive Types** | **Complex Types** |

### Primitive Types

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#primitive), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#primitive) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#primitive).

*todo*

### Attachment

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Attachment) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Attachment).

### Identifier

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#identifier), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#identifier) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#identifier).

### Coding

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Coding) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Coding).

### CodeableConcept

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#CodeableConcept) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#CodeableConcept).

### Quantity

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Quantity) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Quantity).

### Range

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Range) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Range).

### Ratio

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Ratio), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Ratio) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Ratio).

### Period

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Period) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Period).

### SampledData

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#SampledData), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#SampledData) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#SampledData).

### HumanName

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#HumanName) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#HumanName).

### Address

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Address) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Address).

### ContactPoint

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#ContactPoint) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#ContactPoint).

### Timing

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Timing) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Timing).

### Signature

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Signature) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Signature).

### Annotation

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Annotation) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Annotation).

# datatypes-examples.html

## Data Type Examples

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page includes additional examples of the data types, based on common usages and questions

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| --- | --- |
| **Primitive Types** | **Complex Types** |

### Primitive Types

A boolean true value:

<active value="true" />

A negative integer value:

<score value="-14" />

A high-precision decimal value:

<pi value="3.14159265358979323846264338327950288419716939937510" />

A stream of bytes, base64 encoded:

<data value="/9j/4...KAP//Z" /> <!-- covers many lines -->

A unicode string:

<caption value="Noodles are called ?? in Chinese" />

A URI that points to a website:

<reference value="http://hl7.org/fhir" />

A URI that is a urn:

<id value="urn:isbn:0451450523" />

A date of birth:

<date value="1951-06-04" />

An approximate date of birth:

<date value="1951-06" />

The instant a document was created, including time zone:

<instant value="2013-06-08T10:57:34+01:00" />

The instant a document was created, expressed in UTC, with milliseconds:

<instant value="2013-06-08T09:57:34.2112Z" />

2:35pm in the afternoon:

<time value="14:35" />

### String Patterns

A URI that is the root oid of HL7:

<root value="urn:oid:2.16.840.1.113883" />

A URI that is a uuid:

<id value="urn:uuid:a5afddf4-e880-459b-876e-e4591b0acc11" />

A code:

<code value="acq4+acq5" />

A code with single internal space:

<code value="Question 4b" />

A numeric id:

<id value="314" />

An alphanumeric id:

<id value="alpha-gamma-14" />

### Attachment

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Attachment) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Attachment).

A PDF document:

<document>

<contentType value="application/pdf" />

<language value="en" />

<data value="/9j/4...KAP//Z" /> <!-- covers many lines -->

<title value="Definition of Procedure" />

</document>

document : {

contentType : { value : "application/pdf" },

language : { value : "en" },

data : { value : "/9j/4...KAP//Z"},

title : { value : "Definition of Procedure" }

}

Since the JSON examples have the same structure as the XML, only XML is shown for the rest of the examples.

A reference to a DICOM image via WADO:

<image>

<contentType value="application/dicom" />

<url value="http://10.1.2.3:1000/wado?requestType=WADO&amp;wado\_details..." />

<hash value="EQH/..AgME" />

</image>

### Identifier

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Identifier) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Identifier).

**Examples**

A primary key from an application table (an OID in the space allocated by HL7 to some organization to further sub-allocate):

<identifier>

<use value="official" />

<system value="urn:oid:2.16.840.1.113883.16.4.3.2.5" />

<value value="123" />

</identifier>

A patient identifier defined by a hospital:

<identifier>

<use value="official" />

<system value="http://www.acmehosp.com/patients" />

<value value="44552" />

<period>

<start value="2003-05-03" />

</period>

</identifier>

In this case, the period is used to track when the identifier was first assigned to the patient.

An identifier that refers to a patient FHIR resource on a particular system:

<identifier>

<system value="urn:ietf:rfc:3986" />

<value value="http://pas-server/xxx/Patient/443556" />

</identifier>

This is not a resource reference - it's a logical reference by the patient identifier.

A UUID:

<identifier>

<use value="temp" />

<system value="urn:ietf:rfc:3986" />

<value value="urn:uuid:a76d9bbf-f293-4fb7-ad4c-2851cac77162" />

</identifier>

UUIDs are often used for temporary identifiers, though this is not necessary.

A US SSN:

<identifier>

<use value="usual" />

<type>

<coding>

<system value="http://hl7.org/fhir/v2/0203"/>

<code value="SSN"/>

</coding>

</type>

<system value="http://hl7.org/fhir/sid/us-ssn" />

<value value="000111111" />

</identifier>

Notes:

* US SSNs are often presented like this: 000-11-1111, the dashes are for presentation and should be removed, as specified in the [definition of ssn-us](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html#identifiersystems)
* The use of "usual" means that this institution prefers to use SSN when identifying the patient

A medical record number assigned on 5-July 2009:

<identifier>

<use value="usual" />

<type>

<coding>

<system value="http://hl7.org/fhir/v2/0203"/>

<code value="MRN"/>

</coding>

</type>

<system value="urn:oid:0.1.2.3.4.5.6.7" />

<value value="2356" />

<period>

<start value="2009-07-05" />

</period>

</identifier>

### Coding

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Coding) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Coding).

**Examples**

A simple code for headache, in ICD-10:

<code>

<system value="http://hl7.org/fhir/sid/icd-10" />

<code value="G44.1" />

</code>

A SNOMED CT expression:

<problem>

<system value="http://snomed.info/sct" />

<code value="128045006:{363698007=56459004}" />

</problem>

### CodeableConcept

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#CodeableConcept) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#CodeableConcept).

**Examples**

A simple code for headache initially coded in SNOMED CT (by picking the SNOMED CT code from a pick-list), and then translated to ICD-10:

<concept>

<coding>

<system value="http://hl7.org/fhir/sid/icd-10" />

<code value="R51" />

</coding>

<coding>

<system value="http://snomed.info/sct" />

<code value="25064002" />

<display value="Headache" />

<userSelected value="true" />

</coding>

<text value="general headache" />

</concept>

A concept represented in an institution's local coding systems for unit for which no UCUM equivalent exists:

<unit>

<coding>

<system value="urn:oid:2.16.840.1.113883.19.5.2" />

<code value="tab" />

<display value="Tablet" />

</coding>

<coding>

<system value="http://unitsofmeasure.org" />

</coding>

</unit>

A SNOMED CT expression:

<diagnosis>

<coding>

<system value="http://snomed.info/sct" />

<code value="128045006:{363698007=56459004}" />

</coding>

<text value="Cellulitis of the foot" />

</diagnosis>

In this case, there is no display element, because no display is defined for SNOMED CT expressions.

Using the valueset:

The results on a urinalysis strip:

<valueCoding>

<system value="http://example.org/codes/simple-grades" />

<code value="+" />

</valueCoding>

And where the value set would be something like this:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

<p>Possible Clinistix codes: neg, trace, +, ++, and +++</p>

</div>

</text>

<identifier value="http://hl7.org/fhir/ValueSet/clinistix"/>

<name value="Codes for Clinistix"/>

<publisher value="HL7"/>

<telecom>

<system value="url"/>

<value value="http://hl7.org/fhir"/>

</telecom>

<description value="Clinistix Codes"/>

<status value="draft"/>

<experimental value="true"/>

<date value="2013-10-01"/>

<codeSystem>

<system value="http://example.org/codes/simple-grades"/>

<caseSensitive value="false"/>

<concept>

<code value="neg"/>

</concept>

<concept>

<code value="trace"/>

</concept>

<concept>

<code value="+"/>

</concept>

<concept>

<code value="+"/>

</concept>

<concept>

<code value="++"/>

</concept>

<concept>

<code value="+++"/>

</concept>

</codeSystem>

</ValueSet>

### Quantity

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Quantity) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Quantity).

**Examples**

A duration:

<time>

<value value="25" />

<unit value="sec" />

<system value="http://unitsofmeasure.org" />

<code value="s" />

</time>

A concentration where the value was out of range:

<result>

<value value="40000" />

<comparator value="&gt;" />

<unit value="mcg/L" />

<system value="http://unitsofmeasure.org" />

<code value="ug" />

</result>

An amount of prescribed medication:

<dose>

<value value="3" />

<unit value="capsules" />

<system value="http://snomed.info/sct" />

<code value="385049006" />

</dose>

A price (coded using currency codes defined in ISO 4217):

<cost>

<value value="25.45" />

<unit value="US$" />

<system value="urn:iso:std:iso:4217" />

<code value="USD" />

</cost>

### Range

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Range) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Range).

**Examples**

Range of Quantity (distance):

<estimate>

<low>

<value value="1.6" />

<unit value="m" />

</low>

<high>

<value value="1.9" />

<unit value="m" />

</high>

</estimate>

### Ratio

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Ratio), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Ratio) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Ratio).

**Examples**

Titer (Ratio of integer:integer)

<result>

<numerator>

<value value="1" />

</numerator>

<denominator>

<value value="128" />

</denominator>

</result>

Unit cost (Ratio of Money:Quantity):

<charge>

<numerator>

<value value="103.50" />

<unit value="US$" />

<code value="USD" />

<system value="urn:iso:std:iso:4217" />

</numerator>

<denominator>

<value value="1" />

<unit value="day" />

<code value="day" />

<system value="http://unitsofmeasure.org" />

</denominator>

</charge>

### Period

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Period) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Period).

**Examples**

23rd May 2011 to 27th May, including 27th May:

<coverage>

<start value="2011-05-23" />

<end value="2011-05-27" />

</coverage>

### SampledData

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#SampledData), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#SampledData) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#SampledData).

**Example**

The output from an EKG device:

<sampledData>

<origin>

<value value="0"/>

<unit value="μV"/>

<system value="http://unitsofmeasure.org"/>

<code value="uV"/>

</origin>

<period value="2"/>

<factor value="2.5"/>

<dimensions value="1"/>

<data value="-4 -13 -18 -18 -18 -17 -16 -16 -16 -16 -16 -17 -18 -18 -18 ...."/>

</sampledData>

### HumanName

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#HumanName) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#HumanName).

A Simple example

<name>

<family value="Everyman" />

<given value="Adam" />

<given value="A." />

</name>

Composite names

<name>

<family value="Contrata" />

<given value="Mary Jane" />

</name>

These cases can be quite ambiguous - is "Mary Jane" one name, or two? Different systems, and data enterers may treat this differently, and the person themselves may not know. Parts are allowed to contain spaces, but systems should consider how to treat these cases. Composite names separated by "-" should be treated as a single name part.

A common pattern: a person is called by a name other than that expected from their official name (first given name in most cultures).

<name>

<use value="official" />

<family value="Chalmers" />

<given value="Peter" />

<given value="James" />

</name>

<name>

<use value="usual" />

<given value="Jim" />

</name>

This same pattern is often encountered with immigrants, who retain their real name for official use, but adopt a localized name for everyday use:

<name>

<use value="official" />

<family value="Sczypinski" />

<given value="Piotr" />

<given value="Andre" />

</name>

<name>

<use value="usual" />

<family value="Skipper" />

<given value="Jim" />

</name>

Karen van Hentenryck is of Dutch origin, and the "van" is a voorvoegsel.

<name>

<use value="official" />

<family value="van">

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >

<valueCode value="VV" />

</extension>

</family>

<family value="Hentenryck" />

<given value="Karen" />

</name>

See [the Extensibility Example for more information](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-examples.html). Note that this name has multiple family name parts. Systems that do not support as many name parts as are provided in an instance they are processing may wish to append parts together using spaces, so that this becomes "van Hentenryck".

Complex example from Germany: Dr.phil. Regina Johanna Maria GrÃ¤fin Hochheim-Weilenfels, NCFSA. This example shows extensive use of multiple given names, prefixes, suffixes, for academic degrees, nobility titles, and professional designations.

<name>

<use value="official" />

<family value="Hochheim-Weilenfels" />

<given value="Regina" />

<given value="Johanna" />

<given value="Maria" />

<prefix value="GrÃ¤fin">

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >

<valueCode value="NB" />

</extension>

</prefix>

<prefix value="Dr. phil.">

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >

<valueCode value="AC" />

</extension>

</prefix>

<suffix value="NCFSA" />

</name>

<name>

<use value="maiden" />

<family value="Hochheim" />

</name>

This example makes use of the ISO 21090 extensions to carry the rare ISO 21090 qualifier attributes "AC" and "NB".

Japanese example in the three forms: ideographic (Kanji), syllabic (Hiragana) and alphabetic (Romaji).

<name>

<family value="??" />

<given value="??" />

</name>

<name>

<family value="???" />

<given value="???" />

</name>

<name>

<family value="KIMURA" />

<given value="MICHIO" />

</name>

The three forms are differentiated by the character subset each contains.

Russian example in the two forms: cyrillic, and latin:

<name>

<family value="??????" />

<given value="????" />

<given value="????????????" />

</name>

<name>

<family value="EMELIN" />

<given value="IVAN" />

<given value="VLADIMIROVICH" />

</name>

In Russian usage, these names are known as the domestic and foreign names respectively. The two forms are differentiated by the character subset each contains.

Scandinavian example: Erikson is the family name. Jan Erik are the given names, and Ã–stlund the family name of the mother, which is taken as a Mellannamn.

<name>

<use value="official" />

<family value="Erikson" />

<given value="Jan" />

<given value="Erik" />

<given value="Ã–stlund">

<extension url="http://hl7.org/fhir/StructureDefinitioniso-20190#name-qualifier" >

<valueCoding>

<code value="MID" />

<system value="http://hl7.org/fhir/v3/EntityNamePartQualifier2" />

</valueCoding>

</extension>

</given>

</name>

This example makes use of the ISO 21090 extension to carry the culture specific ISO 21090 qualifier attribute "MID" for the Mellannamn.

Then Jan Erikson has a daughter, Karin, with his wife Margrete Hansen. The first communications of the new born name is "Margrete Jente" (Margrete's Girl) and the mother's family name, not the given name (Karin). The father's Family name is not used at all. This is a known temporary name assigned directly after the birth of the child.

<name>

<use value="temp" />

<!-- use could be OR+OLD, depends how record keeping is done -->

<family value="Hansen" />

<given value="Margrete Jente" />

</name>

The baby's name is subsequently changed to the fathers' family name, and to use the mother's name as mellomnamn.

<name>

<use value="official" />

<family value="Erikson" />

<given value="Karin" />

<given value="Hansen">

<extension url="http://hl7.org/fhir/StructureDefinitioniso-20190#name-qualifier" >

<valueCoding>

<code value="MID" />

<system value="http://hl7.org/fhir/v3/EntityNamePartQualifier2" />

</valueCoding>

</extension>

</given>

</name>

Later, Karin gets married to Per Berg, and decides to adopts Berg as her family name, and also decides to use Erikson as the mellom navn. (Note: Karin could have chosen to use another mellom navn, e.g. the family name of her mother, her father or other family names as specified by naming laws of the country in question).

<name>

<use value="old" />

<family value="Erikson" />

<given value="Karin" />

<given value="Hansen">

<extension url="http://hl7.org/fhir/StructureDefinitioniso-20190#name-qualifier" >

<valueCoding>

<code value="MID" />

<system value="http://hl7.org/fhir/v3/EntityNamePartQualifier2" />

</valueCoding>

</extension>

</given>

</name>

<name>

<use value="official" />

<family value="Berg" />

<given value="Karin" />

<given value="Erikson">

<extension url="http://hl7.org/fhir/StructureDefinitioniso-20190#name-qualifier" >

<valueCoding>

<code value="MID" />

<system value="http://hl7.org/fhir/v3/EntityNamePartQualifier2" />

</valueCoding>

</extension>

</given>

</name>

<name>

<use value="usual" />

<family value="Berg" />

<given value="Karin" />

</name>

#### W3C International Examples

These examples are taken from the [W3C International Examples](http://www.w3.org/International/questions/qa-personal-names), which should be consulted for further information.

A patronymic is "The part of a name that links to the genealogy":

<name>

<text value="BjÃ¶rk GuÃ°mundsdÃ³ttir"/>

<family value="GuÃ°mundsdÃ³ttir"/>

<given value="BjÃ¶rk"/>

</name>

A patronymic with a "son/daughter of" appellation:

<name>

<text value="Isa bin Osman"/>

<family value="bin Osman"/>

<given value="Isa"/>

</name>

Note: The family name may also be given as two different family names.

A Chinese name with a generational name:

<name>

<text value="???"/> <!-- left to right -->

<family value="?"/>

<given value="?"/>

<given value="?"/>

</name>

<name>

<text value="Mao Ze Dong"/> <!-- left to right -->

<family value="Mao"/>

<given value="Ze"/>

<given value="Dong"/>

</name>

*Todo: is there a need to identify the given name that is the generational name*.

Additional Western name (see also example above):

<name>

<use value="official" />

<family value="Yao" />

<given value="Ming" />

</name>

<name>

<use value="usual" />

<given value="Fred" />

</name>

Multiple Family names:

<name>

<family value="CarreÃ±o" />

<family value="QuiÃ±ones" />

<given value="MarÃ­a-Jose" />

</name>

Brazilian Example:

<name>

<family value="Eduardo" />

<family value="Santos" />

<family value="Tavares" />

<family value="Melo" />

<family value="Silva" />

<given value="JosÃ©" />

</name>

Russian Examples (using Cyrillic):

<name>

<family value="??????????" />

<family value="??????" />

<given value="?????" />

</name>

<name>

<family value="?????????" />

<family value="???????" />

<given value="?????" />

</name>

Example with Initial:

<name>

<family value="Public" />

<given value="John" />

<given value="Q." />

</name>

Other Examples:

<name>

<text value="Velikkakathu Sankaran Achuthanandan"/>

<family value="Velikkakathu" />

<given value="Sankaran" />

<given value="Achuthanandan" />

</name>

<name>

<text value="Kogaddu Birappa Timappa Nair"/>

<family value="Nair" />

<given value="Birappa" />

<given value="Timappa" />

<prefix value="Kogaddu" />

</name>

<name>

<text value="Aditya Pratap Singh Chauhan"/>

<family value="Singh" />

<given value="Aditya" />

<given value="Pratap" />

<suffix value="Chauhan" />

</name>

<name>

<text value="Madurai Mani Iyer"/>

<given value="Mani" />

<prefix value="Madurai" />

<suffix value="Iyer" />

</name>

<name>

<text value="Abu Karim Muhammad al-Jamil ibn Nidal ibn Abdulaziz al-Filistini"/>

<family value="ibn Nidal" />

<family value="ibn Abdulaziz" />

<given value="Muhammad" />

<given value="al-Jamil" />

<prefix value="Abu Karim" />

<suffix value="al-Filistini" />

</name>

*Todo: need to discuss this with Indian / Arabic implementers*. Note that collecting and storing the *text* element makes the primary purpose of the structured parts for index/searching, and fidelity of the name parts is not critical.

### Address

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Address) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Address).

Note about these examples: the most important element in an address is the 'text' element - this defines what is printed on the envelope, the actual postal address. The other data elements are provided to support either data analysis based on a patient's address, or for the many systems that exchange fully structured addresses specific to a particular culture. For this reason, these examples focus on the structured data elements of the address.

**Example**

HL7 office's address.

<address>

<use value="work" />

<text value="1050 W Wishard Blvd RG

5th floor Indianapolis, IN 46240" />

<line value="1050 W Wishard Blvd" />

<line value="RG 5th floor" />

<city value="Indianapolis" />

<state value="IN" />

<postalCode value="46240" />

</address>

A UK example address, with the county 'HUDDERSFIELD'.

<address>

<text value="1 Back Lane&#13;&#10;Holmfirth&#13;&#10;HUDDERSFIELD&#13;&#10;HD7 1HQ"/>

<line value="1 Back Lane"/>

<city value="Holmfirth"/>

<district value="HUDDERSFIELD"/>

<postalCode value="HD7 1HQ"/>

</address>

A Postal address - i.e. an address that it doesn't make sense to try and visit.

<address>

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-AD-use">

<valueCode value="PST"/>

</extension>

<line value="PO Box 31445"/>

<city value="Erewhon"/>

<postalCode value="0001"/>

</address>

The next set of examples are taken from the official [international postal union](http://www.upu.int) examples.

|  |  |
| --- | --- |
| Rue LougoraÃ¯a 12, app. 10 | thoroughfare type, name and number, apartment |
| Korolevo | locality |
| 223016 NOVY DVOR | postcode + post office name |
| Minsk | District name of district |
| Minsk | Region name of region |
| BELARUS | Country |

<address>

<line value="Rue LougoraÃ¯a 12, app. 10"/>

<city value="Korolevo"/>

<district value="Minsk"/>

<state value="Minsk" />

<country value="BELARUS" />

</address>

|  |  |
| --- | --- |
| Protea Apt 12 | apartment number |
| 22 Ally Hassan Mwinyi | premise + street |
| 14111 MSASANI | postcode + locality |
| DAR ES SALAM | province |
| TANZANIA | country |

<address>

<line value="Protea Apt 12"/>

<line value="22 Ally Hassan Mwinyi"/>

<city value="MSASANI"/>

<state value="DAR ES SALAM" />

<postalCode value="14111"/>

<country value="TANZANIA" />

</address>

|  |  |
| --- | --- |
| 15 Shiri | premise + sub-locality 2 |
| Kimashuku Village | sub-locality |
| 25204 MACHAME KUSINI | postcode + locality |
| HAI | sub-province |
| KILIMANJARO | province |
| TANZANIA | country |

<address>

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-ADXP-precinct">

<valueCode value="Kimashuku Village"/>

</extension>

<line value="15 Shiri"/>

<city value="MACHAME KUSINI"/>

<district value="HAI"/>

<state value="KILIMANJARO" />

<postalCode value="25204"/>

<country value="TANZANIA" />

</address>

|  |  |
| --- | --- |
| 705-1104 | building number + door |
| 56, Dalgubeol-daero 323beon-gil, Suseong-gu | street |
| Daegu | city |
| Rep. OF KOREA | country |
| 706-907 | postcode |

<address>

<line value="705-1104"/>

<line value="56, Dalgubeol-daero 323beon-gil, Suseong-gu"/>

<city value="Daegu"/>

<country value="Rep. OF KOREA" />

<postalCode value="706-907"/>

</address>

|  |  |
| --- | --- |
| 3F | building floor |
| 42, Toegye-ro 77beon-gil | street |
| Chuncheon-si | city |
| Gangwon-do | province |
| Rep. OF KOREA | country |
| 200-066 | postcode |

<address>

<line value="3F"/>

<line value="42, Toegye-ro 77beon-gil"/>

<city value="Chuncheon-si"/>

<state value="Gangwon-do" />

<country value="Rep. OF KOREA" />

<postalCode value="200-066"/>

</address>

|  |  |
| --- | --- |
| Ga-B101 | building number + door |
| 136, Sesil-ro | street |
| Busan | city |
| Rep. OF KOREA | country |
| 612-837 | postcode |

<address>

<line value="Ga-B101"/>

<line value="136, Sesil-ro"/>

<city value="Busan"/>

<country value="Rep. OF KOREA" />

<postalCode value="612-837"/>

</address>

### ContactPoint

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#ContactPoint) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#ContactPoint).

**Example**

Home phone number:

<telecom>

<system value="phone" />

<value value="(555) 675 5745" />

<use value="home" />

</telecom>

In ISO 21090, CDA and other Version 3 specifications, the TEL data type requires that the telephone number be represented as a formal URI in [RFC 3166](http://www.ietf.org/rfc/rfc3966.txt) syntax. Many CDA documents violate this rule, since the telephone numbers are not collected from the user in conformance with the underlying rules (particularly around extensions, nots about use, etc), so the base FHIR type does not require the phone number to be conformant. A ISO 21090 extension can be used to convey this if desired:

**Example**

Formally correct URI:

<telecom>

<extension uri="http://hl7.org/fhir/StructureDefinition/iso21090-TEL-address" >

<valueUri value="tel:+15556755745" />

</extension>

<system value="phone" />

<value value="(555) 675 5745" />

<use value="home" />

</telecom>

### Timing

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Timing) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Timing).

**Example**

A series of appointments for radiotherapy:

<schedule>

<event value="2012-01-07T09:00:00+10:00" />

<event value="2012-01-14T09:00:00+10:00" />

<event value="2012-01-22T11:00:00+10:00" />

</schedule>

BID (twice a day) (no start or end specified):

<schedule>

<repeat>

<frequency value="2" />

<period value="1" />

<periodUnits value="d" />

</repeat>

</schedule>

1/2 an hour before breakfast for 10 days from 23-Dec 2011:

<schedule>

<repeat>

<boundsPeriod>

<start value="2011-12-23" />

<end value="2012-01-02" />

</boundsPeriod>

<when value="ACM" />

<period value="30" />

<periodUnits value="min" />

</repeat>

</schedule>

Note that the end date is inclusive like the end date of a Period.

TID, for 14 days:

<schedule>

<repeat>

<boundsDuration>

<value value="14" />

<unit value="d" />

<system value="http://unitsofmeasure.org" />

<unit value="d" />

</boundsDuration>

<frequency value="3" />

<period value="1" />

<periodUnits value="d" />

</repeat>

</schedule>

BID, start on 7/1/2015 at 1:00 PM:

<schedule>

<repeat>

<boundsPeriod>

<start value="2015-07-01T13:00:00" />

</boundsPeriod>

<frequency value="2" />

<period value="1" />

<periodUnits value="d" />

</repeat>

</schedule>

### Signature

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Signature) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Signature).

**Example**

todo

<signature>

<!-- todo -->

</signature>

### Annotation

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Annotation) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Annotation).

**Example**

todo

<Annotation>

<!-- todo -->

</Annotation>

# datatypes-mappings.html

## Data Type Mappings

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page provides mappings for the data types. There are mappings to HL7 v2, v3, and (where appropriate) vCard.

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| **Primitive Types** | **Complex Types** |

### Primitive Types

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#primitive), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#primitive) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#primitive).

### Attachment

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Attachment) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Attachment).

### Identifier

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#identifier), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#identifier) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#identifier).

### Coding

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Coding) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Coding).

### CodeableConcept

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#CodeableConcept) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#CodeableConcept).

### Quantity

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Quantity) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Quantity).

### Range

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Range) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Range).

### Ratio

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Ratio), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Ratio) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Ratio).

### Period

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Period) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Period).

### SampledData

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#SampledData), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#SampledData) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#SampledData).

### HumanName

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#HumanName) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#HumanName).

[**vCard**](http://tools.ietf.org/html/rfc6350) **Mappings**

* HumanName.text = vCard "FN" field
* HumanName.use = use of the vCard "TYPE" parameter
* HumanName.family, .given, .prefix, .suffix = parts of vCard "N" field. Note that there is no FHIR equivalent for the poorly defined "additional" name field. In FHIR, given names go in "middle" names
* The vCard nickname corresponds to a name with the use "nickname"

### Address

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Address) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Address).

### ContactPoint

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#ContactPoint) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#ContactPoint).

### Timing

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Timing) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Timing).

### Signature

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Signature) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Signature).

### Annotation

See also [Base Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation), [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Annotation) and [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Annotation).

# datatypes.html

# Data Types

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The FHIR specification defines a set of data types that are used for the resource elements. There are two categories of data type: simple / primitive types, which are single elements, and complex types, which are re-usable clusters of elements. This page describes the data types. See also the [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html).

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| **Primitive Types** | **Complex Types** |

White = abstract type. Light blue - types. Light Pink - Profile on Type. The data types are also available as a [W3C Schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-base.xsd).

## Primitive Types

The following table describes the primitive types that are used in this specification. Primitive types are those with only a value, and no additional elements as children (though, like all types, they have [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)).

|  |  |  |
| --- | --- | --- |
| **Primitive Types** | | |
| **FHIR Name** | **Value Domain** | **XML Representation** | **JSON representation** |
| boolean | true | false | xs:boolean, except that **0 and 1 are not valid values** | JSON boolean (true or false) |
| integer | A signed 32-bit integer (for larger values, use decimal) | xs:int, except that **leading 0 digits are not allowed** | JSON number (with no decimal point) |
| string | A sequence of Unicode characters | xs:string | JSON String |
|  | Note that strings SHALL NOT exceed 1MB in size | | |
| decimal | Rational numbers that have a decimal representation. See below about the precision of the number | xs:decimal, except that **decimals may not use exponents, and leading 0 digits are not allowed** | A JSON number, except that **exponents are not allowed** |
| uri | A Uniform Resource Identifier Reference ([RFC 3986](http://tools.ietf.org/html/rfc3986)). Note: URIs are case sensitive. For UUID (urn:uuid:53fefa32-fcbb-4ff8-8a92-55ee120877b7) use all lowercase | xs:anyURI | A JSON string - a URI |
|  | URIs can be absolute or relative, and may have an optional fragment identifier | | |
| base64Binary | A stream of bytes, base64 encoded ([RFC 4648](http://tools.ietf.org/html/rfc4648)) | xs:base64Binary | A JSON string - base64 content |
|  | Todo: is it possible to impose an upper absolute limit on a base64Binary (for denial of service reasons, like on string) | | |
| instant | An instant in time - **known at least to the second and always includes a time zone**. Note: This is intended for precisely observed times (typically system logs etc), and not human-reported times - for them, use date and dateTime. instant is a more constrained dateTime | xs:dateTime | A JSON string - an xs:dateTime |
|  | Note: This type is for system times, not human times (see date and dateTime below). | | |
| date | A date, or partial date (e.g. just year or year + month) as used in human communication. **There is no time zone**. Dates SHALL be valid dates | union of xs:date, xs:gYearMonth, xs:gYear | A JSON string - a union of xs:date, xs:gYearMonth, xs:gYear |
|  | Regex: -?[0-9]{4}(-(0[1-9]|1[0-2])(-(0[0-9]|[1-2][0-9]|3[0-1]))?)? | | |
| dateTime | A date, date-time or partial date (e.g. just year or year + month) as used in human communication. If hours and minutes are specified, a time zone SHALL be populated. Seconds must be provided due to schema type constraints but may be zero-filled and may be ignored. Dates SHALL be valid dates. **The time "24:00" is not allowed** | union of xs:dateTime, xs:date, xs:gYearMonth, xs:gYear | A JSON string - a union of xs:dateTime, xs:date, xs:gYearMonth, xs:gYear |
|  | Regex: -?[0-9]{4}(-(0[1-9]|1[0-2])(-(0[0-9]|[1-2][0-9]|3[0-1])(T([01][0-9]|2[0-3]):[0-5][0-9]:[0-5][0-9](\.[0-9]+)?(Z|(\+|-)((0[0-9]|1[0-3]):[0-5][0-9]|14:00))?)?)?)? | | |
| time | A time during the day, with no date specified (can be converted to a [Duration](#Duration) since midnight). Seconds must be provided due to schema type constraints but may be zero-filled and may be ignored. **The time "24:00" is not allowed, and neither is a time zone** | xs:time | A JSON string - an xs:time |
|  | Regex: ([01][0-9]|2[0-3]):[0-5][0-9]:[0-5][0-9](\.[0-9]+)? | | |

Notes:

* For all the types, the XML and JSON representations are the same except for different escaping in XML and JSON
* Boolean values can also be represented using coded values (such as [HL7 v2 2 Table 0136](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v2\0136\index.html)). See [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html#valuex) for one such use
* The regexes may allow a broader set of values than are actually valid (e.g. leap years) so additional validation is needed
* The precision of the decimal value has signficance:
  + e.g 0.010 is regarded as different to 0.01, and the original precision should be preserved
  + Implementations SHALL handle decimal values in ways that preserve and respect the precision of the value as represented for presentation purposes
  + Implementations are not required to perform calculations with these numbers differently, though they may choose to do so (i.e. preserve significance)
  + See implementation comments for [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html#schema-gen), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html#decimal) and [RDF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rdf.html#decimal)
  + In object code, implementations that might meet this constraint are GMP implementations or equivalents to Java BigDecimal that implement arbitrary precision, or a combination of a (64 bit) floating point value with a precision field
  + Note that there is no absolute limit to the magnitude of the value, though large and/or highly precise values are extremely rare in medicine. One element where highly precise decimals may be encountered is the [Location](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\location.html) coordinates

### XML and JSON representations

All elements using these primitive types have some combination of value as described above, an internal identity (e.g. xml:id), and extensions. The value is represented in XML as an attribute named "value":

<count value="2"/>

and as the value of the property in JSON:

"count" : 2

For additional details, including how the internal identity and extensions are represented, see the [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) and [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html) formats. When the value is missing, it is not represented in the instance; the XML value attribute or the JSON property are not represented at all. This means that in xml, attributes are never present with a length of 0 (value=""), and properties are never a 0 length string or null in JSON ("name" : "" it not valid). (note: there is one specific [use of the null](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html#null) in the JSON represesntation).

According to XML schema, leading and trailing whitespace in the value attribute is ignored for the types boolean, integer, decimal, base64Binary, instant, uri, date, dateTime, oid, and uri. Note that this means that the schema aware XML libraries give different attribute values to non schema aware libraries when reading the XML instances. For this reason, the value attribute for these types SHOULD not have leading and trailing spaces. String values should only have leading and trailing spaces if they are part of the content of the value. In JSON, whitespace in string values is always significant. Primitive types other than string SHALL NOT have leading or trailing whitespace.

### Simple Restrictions

In addition to the base primitive types, a few additional primitive types are defined as restrictions on one of the other primitive types.

|  |  |  |
| --- | --- | --- |
| **FHIR Name** | **Base FHIR Type** | **Description** |
| code | string | Indicates that the value is taken from a set of controlled strings defined elsewhere (see [Using codes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) for further discussion). Technically, a code is restricted to string which has at least one character and no leading or trailing whitespace, and where there is no whitespace other than single spaces in the contents  regex: [^\s]+([\s]+[^\s]+)\* |
| oid | uri | An OID represented as a URI ([RFC 3001](http://www.ietf.org/rfc/rfc3001.txt)). e.g. urn:oid:1.2.3.4.5 |
| id | string | Any combination of upper or lower case ASCII letters ('A'..'Z', and 'a'..'z', numerals ('0'..'9'), '-' and '.', with a length limit of 64 characters. (This might be an integer, an un-prefixed OID, UUID or any other identifier pattern that meets these constraints.)  regex: |
| markdown | string | A string that may contain markdown syntax for optional processing by a mark down presentation engine |
| unsignedInt | int | Any non-negative integer (e.g. >= 0) regex: [0-9]+ |
| positiveInt | int | Any positive integer (e.g. > 0) regex: [1-9][0-9]\* |

Some additional notes about the id datatype:

* Ids are case sensitive. UUIDs SHALL be sent using lowercase letters
* The ID type includes identifiers consistent with [ISO 18232](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=38610), but also includes other identifier formats as well, and is not case insensitive like ISO 18232.
* In a typical FHIR URL, like http://example.com/fhir/Patient/1234, the last part "1234" (highlighted in navy) is the part that is an id datatype
* A full UUID is a uri, not an id. UUIDs in URIs SHALL also be represented in lowercase (urn:uuid:59bf0ef4-e89c-4628-9b51-12ae3fdbe22b), which SHALL be in lowercase

Some additional notes about the markdown datatype:

* Systems are not required to have markdown support, and there is considerable variation in markdown syntax, so the content of the string should be readable without markdown processing, per merkdown philosophy
* The preferred markdown syntax is described at <http://daringfireball.net/projects/markdown/syntax> (see tests here: <http://daringfireball.net/projects/downloads/MarkdownTest_1.0.zip>)

**DSTU Note:** [CommonMark](http://commonmark.org/) is a new arrival but may gain sufficient impetus to be preferred in a future version.

Feedback is welcome [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

## Complex Types

These types are represented as XML Elements with child elements with the name of the defined elements of the type. The name of the element is defined where the type is used. Any of the XML elements may have an [id attribute](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#id). In JSON, the data type is represented by an object with properties named the same as the XML elements. The JSON representation is almost exactly the same, so only the first [example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Attachment) has an additional JSON representation.

Complex data types may be "profiled". A [Structure Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) or type "constraint" makes a set of rules about which elements SHALL have values, and what the possible values are.

**UML Diagrams of the Data types**

## Attachment

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Attachment), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Attachment) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Attachment).

This type is for containing or referencing attachments - additional data content defined in other formats. The most common use of this type is to include images or reports in some report format such as PDF. However it can be used for any data that has a mime type.

The actual content of the Attachment can be conveyed directly using the data element or a URL reference can be provided. If both are provided, the reference SHALL point to the same content as found in the data. The reference can never be reused to point to some different data (i.e. the reference is version specific). The URL reference SHALL point to a location that resolves to actual data; some URIs such as cid: meet this requirement. If the URL is a relative reference, it is interpreted in the same way as a [resource reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#references).

The contentType element SHALL always be populated when the attachment contains data, and MAY be populated when there is a url. It can include charset information and other mime type extensions as appropriate. If there is no character set in the contentType then the correct course of action is undefined, though some media types may define a default character set and/or the correct character set may be able to be determined by inspection of the content.

The hash is included so that applications can verify that the content returned by the URL has not changed.

In many cases where Attachment is used, the cardinality is >1. A valid use of repeats is to convey the same content in different mime types and languages. Guidance on the meaning of repeating elements SHALL be provided in the definition of the repeating resource element or extension that references this type. The language element describes the language of the attachment using the [codes defined in BCP 47](http://tools.ietf.org/html/bcp47).

**Constraints**

If neither data nor a URL is provided, the value should be understood as an assertion that no content for the specified mimeType and/or language is available for the combination of language and contentType.

The context of use may frequently make rules about the kind of attachment (and therefore, the kind of mime types) that can be used.

Attachment is used in the following places:

## Coding

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Coding), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Coding) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Coding).

A Coding is a representation of a defined concept using a symbol from a defined "code system" - see [Using Codes in resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) for more details.

The meaning of the Coding is defined by the code. The system provides the source of the definition of the code, along with an optional version reference. The display is a human display for the text defined by the system - it adds no other value.

The system is a URI that references the code system that defines the code. Choosing the correct system is important; for more information about the code system URI, read [Managing Terminology System URIs](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#system). The system URI SHALL NOT contain a reference to a value set (e.g. ValueSet.url). If the code is taken from a ValueSet with an inline code system, ValueSet.codeSystem.system, is the correct value for the system uri.

A code system version may also be supplied. If the meaning of codes within the code system is consistent across releases, this is not required. The version SHOULD be exchanged when this the system does not maintain consistent definitions across versions. Note that the following systems SHOULD always have a version specified:

* National releases of SNOMED CT (consistency of definitions varies amongst jurisdictions, and some jurisdictions may make their own rules on this)
* Various versions of ICD (note: the major releases are labelled as different code systems altogether, but there is veration within versions)

More generally, any classification (e.g. a code system that includes concepts with relative definitions such as "not otherwise coded" will require a version. See the [discussion of code system versions in the Value Set resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html#versioning) for further discussion on versioning.

If present, the code SHALL be a syntactically correct symbol as defined by the system. In some code systems such as SNOMED CT, the symbol may be an expression composed of other predefined symbol (e.g. post-coordination). Note that codes are case sensitive unless specified otherwise by the code system. The display is a text representation of the code defined by the system and is used to display the meaning of the code by an application that is not aware of the system.

Where the code system defines multiple possible display strings, one of these SHALL be used in display. If one is labeled as preferred, it SHOULD be used. If the code system does not define a text representation (e.g. SNOMED CT Expressions) then display cannot be populated, and the meaning of the code won't be accessible to systems that don't understand the code expression.

In some cases, the system may not be known - only the code is known. In this case, no useful processing of the code may be performed unless the system can be safely inferred by the context. This practice should be avoided where possible, as information sharing in a wider context is very likely to arise eventually, and codes cannot be used in the absence of a known system.

If the system is present, and there is no code, then this is understood to mean that there is no suitable code in the system in which to represent the code.

If two codings have the same system, version and code then they have the same meaning. If the version information is missing, or the system, version or the code elements differ, then how they codes are related can only be determined by consulting the definitions of the system(s) and any [mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) available.

A coding may be marked as a "userSelected" if a user selected the particular coded value in a user interface (e.g. the user selects an item in a pick-list). If a user selected coding exists, it is the preferred choice for performing translations etc.

**Constraints**

The context of use (as defined in the resource or applicable profile) usually makes rules about what codes and systems are allowed or required in a particular context by [binding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) the element to a value set.

Coding is used in the following places:

**Design Note**: This specification defines two types for representing coded values:

* **Coding**: a simple direct reference to a code defined by a code system
* **CodeableConcept**: a text description and/or a list of Codings (i.e. a list of references to codes defined by code systems)

The Coding data type corresponds to the simple case of selecting a single code from a code list. However this type is rarely used in the FHIR specifications; long experience with exchanging coded values in HL7 shows that in the general case, systems need to able to exchange multiple translation codes, and/or an original text.

The Coding data type is used directly when there is certainty that the value must be selected directly from one of the available codes, and the list of possible codes is agreed to by all participants. This is not usually the case in the context of FHIR - general interoperability - so Coding is mostly used in extensions, which are usually intended to be defined for a well-controlled context of use.

## CodeableConcept

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#CodeableConcept), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#CodeableConcept) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#CodeableConcept).

A CodeableConcept represents a value that is usually supplied by providing a reference to one or more terminologies or ontologies, but may also be defined by the provision of text. This is a common pattern in healthcare data.

Each coding is a representation of the concept as described above. The concept may be coded multiple times in different code systems (or even multiple times in the same code systems, where multiple forms are possible, such as with SNOMED CT). The different codings may have slightly different granularity due to the differences in the definitions of the underlying codes. There is no meaning associated with the ordering of coding within a CodeableConcept. A typical use of CodeableConcept is to send the local code that the concept was coded with, and also one or more translations to publicly defined code systems such as LOINC or SNOMED CT. Sending local codes is useful and important for the purposes of debugging and integrity auditing.

Whether or not coding elements are present, the text is the representation of the concept as entered or chosen by the user, and which most closely represents the intended meaning of the user or concept. Very often the text is the same as a display of one of the codings. One of the codings may be flagged as the userSelected - the code or concept that the user actually selected directly. When none of the coding elements is marked as userSelected, the text (if present) is the preferred source of meaning.

**Constraints**

The context of use usually makes rules about what codes and systems are allowed or required in a particular context by [binding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) the element to a value set.

CodeableConcept is used in the following places:

## Quantity

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Quantity), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Quantity) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Quantity).

A measured amount (or an amount that can potentially be measured).

The value contains the numerical value of the quantity, including an implicit precision. If no comparator is specified, the value is a point value (i.e. '='). The comparator element can never be ignored.

The units element contains a displayable unit that defines what is measured. The units may additionally be coded in some formal way using the code and the system (see [Coding](#Coding) for further information about how to use the system element).

If the units are able to be coded in UCUM and a code is provided, it SHOULD be a UCUM code. If a UCUM unit is provided in the code then a canonical value can be generated for purposes of comparison between quantities. Note that the units element will often contain text that is actually a valid UCUM unit, but it cannot be assumed that the units element actually contains a valid UCUM unit.

**Constraints**

The context of use may frequently define what kind of measured quantity this is and therefore what kind of units can be used. The context of use may additionally require a code from a particular system. The context of use may also restrict the values for the value or range.

Quantity is used in the following places:

### Defined Variations on Quantity

These are used as types in resource content models, but they are really just a Quantity with some rules:

## Range

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Range), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Range) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Range).

A set of ordered Quantity values defined by a low and high limit.

A Range specifies a set of possible values; usually, one value from the range applies (e.g. "give the patient between 2 and 4 tablets"). Ranges are typically used in instructions.

The units and code/system elements of the low or high elements SHALL match. If the low or high elements are missing, the meaning is that the low or high boundaries are not known and therefore neither is the complete range.

The comparator flag on the low or high elements cannot be present. Note that the Range type should not be used to represent out of range measurements: A quantity type with the comparator element should be used instead.

The low and the high values are inclusive, and are assumed to have arbitrarily high precision. E.g. the range 1.5 to 2.5 includes 1.50, and 2.50 but not 1.49 or 2.51.

**Constraints**

Range is used in the following places:

## Ratio

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Ratio), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Ratio) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Ratio).

A relationship between two Quantity values expressed as a numerator and a denominator.

Common factors in the numerator and denominator are not automatically cancelled out. The Ratio data type is used for titers (e.g., "1:128") and other quantities produced by laboratories that truly represent ratios. Ratios are not simply "structured numbers" - for example blood pressure measurements (e.g. "120/60") are not ratios. In addition, ratios are used where common factors in the numerator and denominator do not cancel out. The most common example of this is where the ratio represents a unit cost, and the numerator is a currency (e.g. 50/$10).

A proper ratio has both a numerator and a denominator; however these are not mandatory in order to allow an invalid ratio with an extension with further information.

**Constraints**

The context of use may require particular types of Quantity for the numerator or denominator.

Ratio is used in the following places:

## Period

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Period), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Period) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Period).

A time period defined by a start and end date/time.

A period specifies a range of times. The context of use will specify whether the entire range applies (e.g. "the patient was an inpatient of the hospital for this time range") or one value from the period applies (e.g. "give to the patient between 2 and 4 pm on 24-Jun 2013").

If the start element is missing, the start of the period is not known. If the end element is missing, it means that the period is ongoing, or the start mey be in the past, and the end date in the future, which means that period is expected/planned to end at the specified time

The end value includes any matching date/time. For example, the period 2011-05-23 to 2011-05-27 includes all the times of 23rd May through to the end of the 27th May.

Period is used in the following places:

## SampledData

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#SampledData), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#SampledData) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#SampledData).

Data that comes from a series of measurements taken by a device, with upper and lower limits. There may be more than one dimension in the data.

A SampledData provides a concise way to handle the data produced by devices that sample a physical particular state at a high frequency. A typical use for this is for the output of an ECG or EKG device.

The digits are a set of decimal values separated by a single space (Unicode character u20). In addition to decimal values, the special values "E" (error), "L" (below detection limit) and "U" (above detection limit) can also be used. If there is more than one dimension, the different dimensions are interlaced - all the data points for a particular time are represented together. The default value for factor is 1.

SampledData is used in the following places:

## Identifier

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Identifier), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Identifier) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Identifier).

A numeric or alphanumeric string that is associated with a single object or entity within a given system. Typically, identifiers are used to connect content in resources to external content available in other frameworks or protocols. Identifiers are associated with objects, and may be changed or retired due to human or system process and errors.

The system referred to by means of a URI defines how the identifier is defined (i.e. how the value is made unique). It might be a specific application or a recognized standard/specification for a set or identifiers or a way of making identifiers unique. The value SHALL be unique within the defined system and have a consistent meaning wherever it appears. Both system and value are always case sensitive.

In addition to the system the provides a uniqueness scope, and the value, identifiers may also have a type, which may be useful when a system encounters identifiers with unknown system values. Note, however, that the type of an identifier is not a well controlled vocabulary with wide variations in practice. The type deals only with general categories of identifiers and SHOULD not be used for codes that correspond 1..1 with the Identifier.system. Some identifiers may fall into multiple categories due to variations in common usage.

FHIR defines [some useful URIs directly](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\identifier-registry.html). OIDs (urn:oid:) and UUIDs (urn:uuid:) may be registered in the [HL7 OID registry](http://hl7.org/oid) and should be if the content is shared or exchanged across institutional boundaries. If the identifier itself is naturally globally unique (e.g. an OID, a UUID, or a URI with no trailing local part), then the system SHALL be "urn:ietf:rfc:3986", and the URI is in the value.

In some cases, the system may not be known - only the value is known (e.g. a simple device that scans a barcode), or the system is known implicitly (simple exchange in a limited context, often driven by barcode readers). In this case, no useful matching may be performed using the value unless the system can be safely inferred by the context. This practice should be avoided where possible, as information sharing in a wider context is very likely to arise eventually, and values without a system are inherently limited in use.

The assigner is used to indicate what registry/state/facility/etc. assigned the identifier.

Identifier is used in the following places:

## HumanName

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#HumanName), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#HumanName) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#HumanName).

A name of a human with text, parts and usage information.

Names may be changed or repudiated. People may have different names in different contexts. Names may be divided into parts of different type that have variable significance depending on context, though the division into parts is not always significant. With personal names, the different parts may or may not be imbued with some implicit meaning; various cultures associate different importance with the name parts and the degree to which systems SHALL care about name parts around the world varies widely.

This table summarizes where common parts of a person's name are found.

|  |  |  |
| --- | --- | --- |
| **Name** | **Example** | **Destination / Comments** |
| Surname | Smith | Family Name |
| First name | John | Given Name |
| Title | Mr | Prefix |
| Middle Name | Samuel | Subsequent Given Names |
| Patronymic | bin Osman | Family Name |
| Multiple family names | CarreÃ±o QuiÃ±ones | Family Name. See note below about repeats |
| Initials | Q. | Given Name as initial ("." recommended) |
| Nick Name | Jock | Given name, with Use = common |
| Qualifications | PhD | Suffix |
| Honorifics | Senior | Suffix |

For further information, including all [W3C International Examples](http://www.w3.org/International/questions/qa-personal-names), consult the [examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#HumanName).

The multiple give and family name parts combine to form a single name. Multiple given and family names are for when a person's name has multiple given names (relatively common across cultures) and multiple surnames (less common). Where a person has alternate names that may be used in place of each other, these are different instances of HumanName.

The text element specifies the entire name as it should be represented. This may be provided instead of or as well as specific parts, and can be built from the parts, though the correct order of assembly is culture dependent: the order of the parts within a given part type has significance and SHALL be observed. The appropriate order between family name and given names depends on culture and context of use.

The parts of a name SHOULD NOT contain whitespace. For family name, hyphenated names such as "Smith-Jones" are a single name, but names with spaces such as "Smith Jones" are broken into multiple parts. For given names, initials may be used in place of the full name if that is all that is recorded. Systems that operate across cultures should generally rely on the text form for presentation, and use the parts for index/search functionality. For this reasons, applications SHOULD populate the text element for future robustness.

Applications updating a name SHALL ensure either that the text and the parts are in agreement, or that only one of the two is present. Systems that do not support as many name parts as are provided in an instance may wish to append some of the parts together using spaces

HumanName is used in the following places:

## Address

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Address), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Address) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Address).

A postal address. There are a variety of postal address formats defined around the world. Postal addresses are often also used to record a location that can be visited to find a patient or person.

The text element specifies the entire address as it should be represented. This may be provided instead of or as well as the specific parts. Applications updating an address SHALL ensure either that the text and the parts are in agreement, or that only one of the two is present.

**Constraints**

Address is used in the following places:

## ContactPoint

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#ContactPoint), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#ContactPoint) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#ContactPoint).

Details for all kinds of technology-mediated contact points for a person or organization, including telephone, email, etc.

If capturing a phone, fax or similar contact point, the value should be a properly formatted telephone number according to [ITU-T E.123](http://www.itu.int/rec/T-REC-E.123-200102-I/e). However, this is frequently not possible due to legacy data and/or clerical practices when recording contact details. For this reason, phone, fax, page and email addresses are not handled as formal URLS. For other kinds of contacts, the system is "other" and the value SHOULD be a URL so that its use can be determined automatically. Typical URL schemes used in the value are http(s) for web addresses, and URL schemes for various kinds of messaging systems. If the value is not a URL, then human interpretation will be required.

The rank element can be used to specify a preference for the order in which a set of contacts is used. Contacts are ranked with lower values coming before higher values. Note that rank does not necessarily follow the order in which the contacts are represented in the instance.

**Constraints**

ContactPoint is used in the following places:

## Timing

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Timing), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Timing) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Timing).

Specifies an event that may occur multiple times. Timing schedules are not used for recording when things did happen, but when they are expected or requested to occur. A Timing schedule can be a list of events and/or criteria for when the event is to happen, which can be expressed in a structured form and/or as a code. When both event and a repeating specification are provided, the list of events should be understood as an interpretation of the information in the repeat structure.

Many systems avoid the complexity of the Timing structure by using a text field for these things (e.g. "Dosage Text"). Those systems do not use the Timing data type. Other systems use a set of 'common' codes - including, but usually not limited to, widely understood acronyms such as "BID". A structured timing specification SHOULD be provided whenever possible, unless the code is BID, TID, QID, AM or PM, which have a ubiquitous meaning.

If the timing schedule has repeating criteria, the repeat can occur a given number of times per the specified duration or in relation to some real world event. If no end condition is specified, the schedule will terminate on some criteria that are expressed elsewhere.

If duration is provided as a [Range](#Range), the units in the Range SHALL be a [UCUM unit of time](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-units-of-time.html).

This table summarises some common uses of the Timing Data Type criteria.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **description** | **duration** | **durationUnits** | **frequency** | **frequencyMax** | **period** | **periodUnits** | **periodMax** | **when** | **bounds[x]** |
| BID |  |  | 2 |  | 1 | d |  |  |  |
| TID |  |  | 3 |  | 1 | d |  |  |  |
| QID |  |  | 4 |  | 1 | d |  |  |  |
| Q6H |  |  | 1 |  | 6 | h |  |  |  |
| Every 8 hours |  |  | 1 |  | 8 | h |  |  |  |
| Every 7 days |  |  | 1 |  | 7 | d |  |  |  |
| 3 times a day |  |  | 3 |  | 1 | d |  |  |  |
| 3-4 times a day |  |  | 3 | 4 | 1 | d |  |  |  |
| Every 4-6 hours |  |  | 1 |  | 4 | h | 6 |  |  |
| Every 21 days for 1 hour | 1 | hr | 1 |  | 21 | d |  |  |  |
| Three times a week for Â½ hour | 0.5 | hr | 3 |  | 1 | wk |  |  |  |
| With breakfast |  |  |  |  |  |  |  | CM |  |
| For 5 minutes, 10 minutes before meals | 5 | min |  |  | 10 | min |  | AC |  |
| TID, for 14 days |  |  | 3 |  | 1 | d |  |  | Duration = 14 days |
| BID, start on 7/1/2015 at 1:00 PM |  |  | 2 |  | 1 | d |  |  | Period, low = 2015-07-01T13:00:00 |
|  |  |  |  |  |  |  |  |  |  |

**Constraints**

Timing is used in the following places:

## Signature

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Signature), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Signature) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Signature).

A Signature holds an electronic representation of a signature and its supporting context in a FHIR accessible form. The signature may either be a cryptographic type (XML DigSig or a JWT), which is able to provide non-repudiation proof, or it may be a graphical image that represents a signature or a signature process.

**Constraints**

Note: One consequence of signing the document is that URLs, identifiers and internal references are frozen and cannot be changed. This might be a desired feature, but it may also cripple interoperability between closed ecosystems where [re-identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html) frequently occurs. For this reason, it is recommended that systems consider carefully the impact of any signature processes. The impact of signatures on [Document bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) and their related processes is the most well understood use of digital signatures.

### XML Signature rules

When the signature is an XML Digital Signature (contentType = application/signature+xml), the following rules apply:

* The Signature.blob is base64 encoded XML-Signature
* The XML-Signature is a [Detached](http://www.w3.org/TR/2002/REC-xmldsig-core-20020212/#def-SignatureDetached) Signature (where the content that is signed is separate from the signature itself)
* The Signature SHOULD conform to XAdES-X-L for support of Long Term signatures. The XAdES-X-L specification adds the timestamp of the signing, inclusion of the signing certificate, and statement of revocation
* When FHIR Resources are signed, the signature is accross the [Canonical XML form](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html#canonical) of the resource(s)
* The Signature SHOULD use the hashing algorithm sha256. Signature validation policy will apply to the signature and determine acceptability
* The Signature SHALL include a â€œCommitmentTypeIndicationâ€ element for the Purpose(s) of Signature. The Purpose can be the action being attested to, or the role associated with the signature. The value shall come from ASTM E1762-95(2013). The Signature.type shall contain the same values as committmentTypeIndication

There are three levels of signature verification:

1. verifying that the Digital Signature block itself has integrity through verifying the signature across the XML-Signature,
2. confirming that the signer was authentic, not revoked, and appropriate to the signature purpose,
3. confirming that the signed content of interest is unmodified using the hash algorithm.

Deviations from these guidelines would need to be expressed in site policy, and would be enumerated in the XML-Signature block. For example some environments may choose a different XAdES profile, hashing algorithm, policy identifier, or signature purpose vocabulary.

Signature is used in the following places:

## Annotation

See also [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html#Annotation), [Detailed Descriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-definitions.html#Annotation) and [Mappings](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-mappings.html#Annotation).

A text note which also contains information about who made the statement and when.

Systems that do not have structured annotations simply communicate a single annotation with no author or time.

This element may need to be included in narrative because of the potential for modifying information.

Annotations **SHOULD NOT** be used to communicate "modifying" information that could be computable (this is a SHOULD because enforcing user behavior is nearly impossible).

Annotation is used in the following places:

## Open Type Element

Some elements do not have a specified type. The type is represented by the wildcard symbol "\*". In these cases, the element type may be one of the following:

* [boolean](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#boolean)
* [integer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer)
* [decimal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#decimal)
* [base64Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#base64Binary)
* [instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#instant)
* [string](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#string)
* [uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)
* [date](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#date)
* [dateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime)
* [time](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#time)
* [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code)
* [oid](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#oid)
* [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id)
* [unsignedInt](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#unsignedInt)
* [positiveInt](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#positiveInt)
* [markdown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#markdown)
* [Annotation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation)
* [Attachment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment)
* [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier)
* [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept)
* [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding)
* [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity)
* [Range](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range)
* [Period](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period)
* [Ratio](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Ratio)
* [SampledData](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#SampledData)
* [Signature](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature)
* [HumanName](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName)
* [Address](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address)
* [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint)
* [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing)
* [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference) - a reference to another resource
* [Meta](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#Meta)

The element name ends with "[x]", and this is replaced with the Title cased name of the data type.

Open references are used in the following places:

## Other Types

The following types are defined as part of the data types, but are documented elsewhere in the specification:

* [**Resource**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) - the conceptual base class for all resources
* [**Reference**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference) - for references from one resource to another
* [**Extension**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) - used to convey additional data in a resource
* [**Narrative**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html#Narrative) - conveys a human-readable representation of the content of a resource

# defining-extensions.html

## Defining Extensions

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

All extensions used in resources require a formal published definition which can be used by application developers, or the applications themselves, to help integrate extensions into the healthcare process they support.

Every extension in a resource refers directly to its definition, which is made available as a [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html). A resource can be [profiled](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) to specify where particular extensions are used.

Whenever resources containing extensions are exchanged, the definitions of the extensions SHALL be available to all the parties that share the resources. Each extension contains a URI that references the source of the definitions as a [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html). The source SHOULD be a literal reference, such as an http: url that refers to an end-point that responds with the contents of the definitions - preferably a [FHIR RESTful server](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) supporting the Resources Profile, or a logical reference (e.g. using a urn:) - for instance, to a national published standard. Extensions may be defined by any project or jurisdiction, up to and including international standards organizations such as HL7 itself.

Before defining a new extension, attempt to reuse existing extensions defined in one of the [shared registries described below](#registration). As well, some concepts may be appropriate to adding as part of the core specification.

### Core Elements

Elements are included as part of FHIR resources and data types principally on the basis of current world-wide usage patterns. Policy is that if a significant majority of systems throughout the world that would use a resource or data type would use an element, then that element will be included as part of the resource/data type. If not, it will be left to an extension. This holds even if the element is very common or even mandatory in one or two specific jurisdictions.

[Proposals](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse&tracker_id=677) suggesting a new core element can be raised by anyone. (Free registration is required.) However, given the [timelines](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html) for new FHIR releases as well as the uncertainties associated with vetting the specification through a ballot process, it may still be necessary to define extensions even for elements that are likely to be supported as part of the core specification in a future release.

### Context

Extensions are always defined against some particular context - the type of element that they may be used to extend. The following are possible contexts for an extension:

|  |  |  |  |
| --- | --- | --- | --- |
| **Code** | **Context type** | **Context format** | **Examples** |
| resource | A particular element (including the root) in a single resource | The element path for that element, using the standard dotted notation | Condition Condition.code |
| datatype | A particular element (including the root) in a particular data type | The data type name for primitive types or the element path for complex data types. These extensions can be used anywhere the data type is used | Address.part.value string |
| mapping | A particular context in one of the mapped reference models | The name of the reference model followed by the mapping path. The details of the path depend on the named mapping | RIM: Act[moodCode="EVN"] |
| extension | Another extension | The profile URI of the extension followed by the extension code | http://myextensions.org/someExtension |

Note: For type 'resource' and 'datatype', if the context is an element that can have multiple types, then use (e.g.) Observationn.value[x] if the extension works on all choice types, or otherwise an enumeration of explicitly named elements if not (e.g. Observation.valueQuantity)

In addition, the extension definition might apply additional constraints with regards to particular element values of the target that make its use appropriate. Extensions SHALL only be used on a target for which they are defined.

### Publishing Extension Definitions

As well as defining the base element structure for resources, HL7 also publishes extensions, including as [part of this specification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-registry.html). HL7 publishes such data definitions as extensions rather than as part of the base resource structure in order to keep the base resource structure simple and concise, and to allow implementers not to engage with an entire world's worth of functionality up front. Note that HL7 does not generally define "modifier" extensions - if HL7 publishes an element that modifies the meaning of other elements, it will mostly be part of the resource content itself, since everyone has to understand the extension anyway.

Before extensions can be used in instances, their definition SHALL be published. HL7 maintains two extension registries:

1. HL7 approved extensions, approved by an appropriate part of the HL7 community following a review process, and which have formal standing
2. Provided as a service to the community, where anyone can register an extension

Users are encouraged to register their extensions in the second registry, though this is not required. All that is required is that the extension is published in a context that is available for users of the extension. So, for example, if a particular extension is only used within a single institution, the definition of the extension can be placed on the institution's intranet. However since, by their nature, resources tend to travel well, it's always better to use the HL7 or other publicly accessible extension registries.

The HL7 FHIR registry can be found at <http://fhir.org/registry>.

HL7 extension definitions may be balloted alongside resource content as part of the FHIR specification or may be published as part of separate specifications. When HL7 publishes extension definitions as part of the FHIR specification, these extensions SHALL be used for this data whenever the data is represented in instances. Applications SHOULD use other HL7-defined extensions published to represent equivalent data in the interest of maximum interoperability.

To minimize complexity for implementers, HL7 will not elevate widely adopted extensions (defined by HL7 or other organizations) to be content defined in a core resource in future versions of the resource unless there is widespread endorsement of such a migration from the implementer community. This policy ensures that widespread adoption of an extension does not result in a forced migration to a core element. Extensions labeled as draft may be moved in either direction, but after extensions are finalised as normative they won't be moved.

In some cases, an HL7 work group or other body may publish a profile whose sole purpose is to define extensions expected to be needed by implementers in a particular context. E.g. extensions needed to map a particular set of v2 segments or a v3 model.

Implementations are encouraged to share their extensions with HL7 and register them with the HL7 extension registry. The domain committees will work to elevate the extensions into HL7 published extensions or, if adopted by a broad enough portion of the implementer community, the into the base resource structure itself.

To avoid interoperability issues, extensions SHALL NOT change their definition once published. (Small clarifications to descriptions that do not affect interoperability are permitted.) Rather than modifying an existing extension, a new extension should be introduced. Revisions to an extension may extend the set of contexts in which the extension apply but may not remove or constrain any context previously listed

# directory.html

## All Published Versions of FHIR

The following versions of FHIR are available:

|  |  |  |
| --- | --- | --- |
| **Date** | **Version** | **Description** |
| **Current Versions** | | |
| [Sept 30, 2014](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\index.html) | 0.0.82 | Current Official Published Version *(Currently: DSTU1 + 2 technical errata)* |
| [(current)](http://hl7-fhir.github.io) | (last commit) | Current Development build (about 40min behind version control, may be incoherent and change rapidly) |
| **DSTU 2 sequence** | | |
| [August 31, 2015](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2015Sep\index.html) | 1.0.0 | DSTU 2 QA Preview + CQIF Ballot (Sep 2015) |
| [April 2, 2015](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2015May\index.html) | 1.0.0 | DSTU 2 Ballot version (May 2015 Ballot) |
| [Dec 12, 2014](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2015Jan\index.html) | 0.4.0 | Draft For Comment (January 2015 Ballot) |
| **DSTU 1 sequence** | | |
| [Sept 30, 2014](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\DSTU1\index.html) | 0.0.82 | **DSTU 1 (Official version)** with 2 technical errata (Permanent home) |
| Sept ?, 2013 | 0.11 | DSTU 1 Ballot version (Missing - hunting for a copy) |
| [Dec 4, 2012](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2013Jan\index.htm) | 0.06 | 2nd Draft for Comment (January 2013 Ballot) |
| [Sep 9, 2012](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2012Sep\index.htm) | 0.05 | 1st Draft for Comment (Sept 2012 Ballot) |
| [May 14, 2012](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\2012May\index.htm) | 0.01 | Oldest Archive version available |

Note: Subsequent to Sept 2013, the FHIR version policy was changed.

# documentation.html

# FHIR Documentation Index

This page provides an index to the FHIR Documentation. In addition to this documentation, there are [implementation assistance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementation.html) (which has important information about how to use FHIR in practice), and the [list of resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html).

|  |  |  |
| --- | --- | --- |
| **Administration**  Documentation Guidance / Background.   * [Full Table of Contents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\toc.html) * [Documentation Guidance & Glossary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html) * [License and Legal Terms](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\license.html) * [Community & Credits](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\credits.html) * [Version History](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html) * [Outstanding Issues](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\todo.html)   **Overview**  Background and Tutorial Information.   * [1 page Summary (Glossy)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\summary.html) * [Overview & Roadmap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview.html) * [Developer's Introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-dev.html) * [Clinical Introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-clinical.html) * [**FHIR Timelines**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html) * [Inter-version Compatibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compatibility.html) | **Resources**  Underlying Definitions for Resources.   * [**Base Resource**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html) * [Conformance Rules](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html) * [Resource Life Cycles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html) * [References between Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html) * [Compartments (Patient based access)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html) * [Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) * [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) & [Extension Registry](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-registry.html) * [Formats:](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html)   + [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html)   + [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)   + [RDF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rdf.html) * [Data Types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) * Infrastructure Types:   + [DomainResource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\domainresource.html)   + [Element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element.html)   + [BackboneElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\backboneelement.html)   + [ElementDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html) * [Ontology](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ontology.html) | **Terminologies**  How codes, systems and value sets are used, and registries of known terminology resources   * [Using Codes in Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) * [System List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html) * [Value Set List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-valuesets.html) * [V2 Table List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v2.html) * [V3 Code System / Value set List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v3.html) * [Mappings between Value sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-conceptmaps.html) * [Identifier Registry](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\identifier-registry.html) * + see the [Terminology Service](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminology-service.html) API |
| Appendices:   * [Comparison with other HL7 Specifications](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison.html) * [How FHIR fits into an EHR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ehr-fm.html) * [Coming Challenges Driving Change](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\change.html) | | |

# documentinformation.html

## Document Information

The document information structure represents information that sets the context of a document, and carries key information such as the subject and author. This information is also generally used for searching.

Notes:

* The author and the attester are often the same person, but this may not be the case in some clinical workflows
* The attester attests to the collated narrative portions of the resources
* The custodian is responsible for the maintenance of the document. Principally, they are responsible for the policy regarding persistence of the documents. They need not actually retain a copy of the document, but they should do so.

# documents.html

# FHIR Documents

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR resources can be used to build documents that represent a composition: a set of coherent information that is a statement of healthcare information, particularly including clinical observations and services. A document is an immutable set of resources with a fixed presentation that is authored and/or attested by humans, organizations and devices.

Documents built in this fashion may be exchanged between systems and also persisted in document storage and management systems, including systems such as IHE XDS.

Applications claiming conformance to this framework claim to be conformant to "FHIR documents" (see [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html)).

FHIR documents may be 'clinical' (focused on patient healthcare information) but may also serve non-clinical purposes (e.g. FHIR Implementation guides, practice guidelines, patient handouts, etc.) HL7 will develop profiles in the future giving additional guidance on appropriate representation of clinical documents in general as well as specific types of clinical documents (e.g. Consolidated CDA).

Note that FHIR defines both this document format and also a [document reference resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html). FHIR documents are for documents that are authored and assembled in FHIR, while the document reference resource is for general references to pre-existing documents.

* [Example discharge summary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\document-example-dischargesummary.html): [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\document-example-dischargesummary.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\document-example-dischargesummary.json.html)

## Document Content

All documents have the same structure: a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) of resources of [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) "document" that has a [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) resource as the first resource in the bundle, followed by a series of other resources, referenced from the Composition resource that provide supporting evidence for the document. The bundle gathers all the content of the document into a single XML or JSON document which may be signed and managed as required. The resources include both human readable and computer processable portions. In addition, the bundle may include [CSS stylesheets](http://www.w3.org/Style/CSS/Overview.en.html), [provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) statements and a signature.

The composition resource is the foundation of the clinical document. It:

* provides identity and its purpose, sets the context of the document
* carries key information such as the subject and author, and who attests to the document
* divides the document up into a series of sections, each with their own narrative

Any resource referenced directly in the Composition SHALL be included in the bundle when the document is assembled. Specifically, this means the following resource references:

Other resources that these referenced resources refer to may also be included in the bundle if the document construction system chooses to so do. Including these additional resources will make the document bigger, but will save applications from needing to retrieve the linked resources if they need them while processing the document. Thus, whether these linked resources should be included or not depends on the implementation environment.

The document bundle SHALL include only:

1. The Composition resource, and any resources directly or indirectly (e.g. recursively) referenced from it
2. A Binary resource containing a stylesheet (as described below)
3. Provenance Resources that have a target which is a resource included in item #1

There are two key identifiers on the document:

* The document identifier (mandatory). This is found in *Bundle.id* and is unique for this instance of the document, and is never re-used
* The Composition identifier (optional). This is found in *Composition.identifier*, and is the same for all documents that are derived from this composition

The document has several dates in it:

* The document date (mandatory). This is found in *Bundle.meta.lastUpdated* and identifies when the document bundle was assembled from the underlying resources
* The Composition date (mandatory). This is found in *Composition.date*, which is when the author wrote the document logically
* The Attestation dates (optional). This is found in *Composition.attester.time* and is when the document was witnessed by the attesters. This would usually be at the same time as the composition date or afterwards
* The Composition last modified time (optional). This is found in *Composition.meta.lastUpdated* for the composition, and is the last date of change of the composition. This must be >= the composition date

Document Bundles may be signed using digital signatures following the rules laid out in the [digital signatures](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\signatures.html) page. The signature SHOULD be provided by a listed attester of the document and the signature SHOULD contain a [KeyInfo element](http://www.w3.org/TR/xmldsig-core/#sec-KeyInfo) that contains a KeyName element whose value is a URI that matches the [fullUri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.entry.fullUri) for the matching attester resource.

Once assembled into a bundle, the document is immutable - its content can never be changed, and the document id can never be reused. Note that the document may be represented in either XML or JSON, and interconverted between these or have its character encoding changed, all the while remaining the same document. However the directly referenced content within the document and the presentation of the document cannot change substantially (such that it changes the clinical meaning of the content). Any additional documents derived from the same composition SHALL have a different document id.

### Document Presentation

When the document is presented for human consumption, applications must present the collated narrative portions in order:

1. The [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) resource Narrative
2. The [subject resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition-definitions.html#Composition.subject) Narrative
3. The [section.text](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition-definitions.html#Composition.section.text) Narratives

The presentation of the document is called the 'attested content' of the document. Additional resources can be included in the bundle (e.g. resources referenced from the List that represent the section.content SHOULD be in the bundle, and other additional resources they reference can be included), but these (and any narrative) are not attested content. Specifically, the Composition.attester attests to the presented form of the document.

The Composition resource narrative should summarize the important parts of the document header that are required to establish clinical context for the document (other than the subject, which is displayed in its own right). To actually build the combined narrative, simply append all the narrative <div> fragments together.

The [XML Tools reference implementation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html#refimpl) includes a XSLT transform that converts an XML document into browser-ready XHTML.

In addition to the [basic style rules about Narratives](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html#css), which must be followed, a document can reference or contain one or more stylesheets that contains additional styles that apply to the collated narrative. This is done by asserting stylesheet links on the feed:

<Bundle xmlns="http://hl7.org/fhir">

<!-- metadata and type -->

<link>

<relation value="stylesheet"/>

<url value="[uri]"/>

</link>

</Bundle>

The url can be an absolute reference to a CSS stylesheet or a relative reference to a Binary resource that carries a CSS stylesheet. Stylesheet references can only refer to a CSS stylesheet - other forms of stylesheet are not acceptable.

Relative (internal) references SHOULD be used for stylesheets, because the viewer may be unable to resolve external content at the time of viewing, due toï¿½technical problems or local policy decisions.

Any stylesheet referenced or used SHALL NOT alter the presentation in such a way that it changes the clinical meaning of the content.

Unless otherwise agreed in local trading partner agreements, applications displaying the collated narrative SHOULD use the stylesheets specified by the document (see [security note](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#stylesheet)). Parties entering into a trading agreement to do otherwise should consider the implications this action will have on their long term scope for document exchange very carefully. If the parties agree to use stylesheets that are not contained in the document, then it may be that they will never be able to share their documents safely in a more general context, such as a regional or national EHR or a global personal health record.

## Document Profiles

[Document profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) are used to describe documents for a particular purpose. Document profiles may make rules about:

* The content of the Composition resource, including
* The structure of the sections in the composition
* Which resources are to be included in the bundle along with the resources that are directly referenced in the Document resource

Applications should consider publishing [conformance statements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) that identify particular documents they support. Documents can identify a profile that they conform to by placing a profile identifier in the Bundle.meta.profile element - see [Profile Tags](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta) for a discussion of the utility of this.

## Document Handling Obligations

The authors/constructors and processors of Clinical Documents, whether human or software, have obligations that they must satisfy.

### Author/Constructor Obligations

A document constructor is an application that creates a document. An author is a human, organization or device that uses the constructor to create a document. Between them, the constructor and the author may create new content resources and/or assemble already existing content resources while performing their tasks. They also have the following responsibilities:

* To assure that the document SHALL contain valid composition that conforms to the rules described here and that only links to other valid resources
* To assure that the content of document SHALL conform to any declared [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) (see below).
* Ensure that the attesters are properly aware of the presentation of the document to which they are attesting

### Processor Obligations

A document processor is an application and/or human user that receives documents, and extracts data from them, or makes decisions because of them. The documents may be received directly from a document constructor, accessed via a document management system or forwarded by a third party. The document processor is responsible for ensuring that received documents are processed and/or rendered in accordance to this specification. A document processor has the obligation to assure that the following rules are followed:

* When storing/transmitting a document, any method may be used as long as the bundled document can be (re-)assembled with sufficient integrity to validate a digital signature
* When presenting the narrative of the document, the rules described above SHALL be followed
* Resources or data from the document may be extracted for additional uses, but such data is no longer considered to be attested by the document author
* Wherever the data from the document is displayed to a user, there SHOULD always be a way for the user to access a presentation of the original document

In addition to these obligations, document receivers SHOULD carefully track the source of documents for new documents that supersede existing documents, particularly when the documents represent compositions that have been retracted. When documents have been replaced, they SHOULD either withdraw data extracted from superseded documents or warn users when they view the document or data taken from it.

## Document End-Points

There are several different RESTful end-points used when working with documents. The use of the various end-points can be best be described by considering the consequences of posting to them:

|  |  |  |
| --- | --- | --- |
| **End-Point** | **Type of Content** | **Description** |
| [baseurl]/Bundle | Document Bundle | This works like a normal end point for managing a type of resource, but it works with whole document bundles - i.e. a read operation returns a bundle, an update gets a bundle and a search returns a bundle of bundles |
| [baseurl]/Composition | Composition Resource | The normal end point for managing composition resources. This can be used while building a document or after breaking a document up into its constituent resources or when using compositions separately from documents |
| [[baseurl]/Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#binary) | Document Bundle | Just store the entire document as a sequence of bytes and return exactly that sequence when requested. There is no way to find content in the /Binary end-point, so usually this would be associated with a [Document Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) so that applications can find and process the document, though this is not required |
| [[baseurl]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#transaction) (e.g. a transaction) | Document Bundle | Ignore the fact that the bundle is a document and process all of the resources that it contains as individual resources. Clients SHOULD not expect that a server that receives a document submitted using this method will be able to reassemble the document exactly. (Even if the server can reassemble the document (see below), the result cannot be expected to be in the same order, etc. Thus a document signature will very likely be invalid.) |

Note: While these end-points are defined for use with document resources and document bundles, it is not necessary to use them. Documents may be transferred between systems using any method desired. In addition, servers and/or specifications may define additional [operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) for handling documents beyond the options described above.

### Generating a Document

A client can ask a server to generate a fully bundled document from a composition resource. For details, see [Generate Document Operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition-operations.html).

# downloads.html

# Downloads

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

|  |  |
| --- | --- |
| **Formal Definitions** | |
| Schema | The FHIR XML schemas come in 2 forms:   * [Validation Schemas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-all-xsd.zip) (includes support schemas, resource schemas, modular & combined schemas, and Schematrons) * [Code Generation Schemas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-codegen-xsd.zip) (See [notes about code-generation schemas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html#schema-gen))   Note: the schemas & schematrons do not contain all of the rules about what makes resources valid. Implementers will still need to be familiar with the content of the specification and with any [profiles that apply to the resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) in order to make a conformant implementation. |
| FHIR Definitions | All the value sets, profiles, etc defined as part of the FHIR specification, and the included implementation guides. The definitions come in 4 different forms - XML or JSON, and with and without text definitions:   * XML: [with text](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation.xml.zip) and [without text](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation-min.xml.zip) * JSON: [with text](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation.json.zip) and [without text](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation-min.json.zip)   Note that the forms without definitions are included to be used with tools that don't use the text definitions (e.g. validation tooling) - they are smaller and load faster |
| Examples | All the resource examples as a zip file. These can be used to initialise testing repositories, etc   * [XML format](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\examples.zip) * [JSON format](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\examples-json.zip) |
| RDF | A set of RDF definitions for FHIR and related specifications in 2 formats:   * [Turtle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir.rdf.ttl.zip) * [RDF/XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir.rdf.xml.zip) |
| **Specification Downloads** | |
| [FHIR Specification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-spec.zip) | The whole specification so that you can host your own local copy (does not include the downloads) |
| **Implementation Tools** | |
| [Validator](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validator.zip) | The official FHIR validator - a Java jar file that can be used to validate resources. See [Validation Tools](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation.html) for further information. Note that the validator needs a Definition Pack (see next download) |
| [Translation File](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\translations.xml) | Translations of common FHIR names and messages into multiple languages (see [wiki](http://wiki.hl7.org/index.php?title=FHIR_Implementation_Page) for instructions on how to add to this) |
| [Icon Pack](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\icon-pack.zip) | The FHIR Icon at various resolutions. Any FHIR Implementation created by an organization that has attended a connectathon is allowed to use the FHIR icon in association with the application (this policy will be reviewed in the future). |
| **Reference Implementations** | |
| These reference implementations are provided for implementer interest and assistance. They may be used in production instances, although HL7 and the contributors accept no liability for their use. These implementations are provided under a standard OSI-approved license (mostly BSD-3-Clause).   Note that these reference implementations are provided to assist to implementers to adopt the specification, and are maintained by the FHIR project team, but are not part of the specification, and implementations are not required to conform to these, nor are they subject to the formal standards process. | |

Other reference implementations not distributed with the specification:

* [Swift-FHIR](https://github.com/smart-on-fhir/Swift-FHIR) - reference implementation for [Swift](https://developer.apple.com/swift/)
* [HAPI-FHIR](http://jamesagnew.github.io/hapi-fhir/) - reference implementation for [Java](https://www.oracle.com/java/index.html)

Note that the reference implementations are generally limited to code for representing the resource contents in their native form and parsing and serializing them as XML and JSON. Some of the implementations provide support for building, using and reasoning with resource definitions. A few implementations include a client that conforms to the RESTful API.

Full blown open source implementations for FHIR, some of which use these reference implementations, are listed on the [HL7 wiki](http://wiki.hl7.org/index.php?title=Open_Source_FHIR_implementations).

It is not necessary to use these particular implementations in order to be conformant. Any other approach may be used, including code generated from the schemas.

# ehr-fm.html

## Appendix: HL7 EHR Functional Model and FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The HL7 EHR System Functional Model provides a reference list of functions that may be present in an Electronic Health Record System. While FHIR is an implementation focused on exchange of information in healthcare, this often happens in the context of an EHR. This table briefly describes one way that FHIR can be used to meet the requirements described in the EHR-FM and is provided to help readers of the FHIR specification understand how FHIR can be used. There are many other equally valid ways to implement the EHR-FM and to make use of FHIR.

|  |  |  |
| --- | --- | --- |
| **EHR Function** | | **FHIR Implementation Notes** |
| IN.1 | Security | FHIR defines parts of the security infrastructure, and delegates others to standard web based security frameworks |
| IN.1.1 | Entity Authentication | FHIR assumes that the users are authenticated. OAuth is the preferred mechanism |
| IN.1.2 | Entity Authorization | FHIR does not currently provide any resources to describe or manage access-control permissions. By default, underlying web frameworks such as SAML would be used. See [the security section](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#binding) for a discussion of binding between FHIR and SAML |
| IN.1.3 | Entity Access Control | See above about SAML / OAuth |
| IN.1.4 | Patient Access Management | See [Security Labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) |
| IN.1.5 | Non-Repudiation | The [provenance resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) tracks the timestamps, actors, digital signatures associated with resources |
| IN.1.6 | Secure Data Exchange | TLS (https:) should be used for all production exchange of data. All conformant FHIR RESTful implementations SHALL be able to use https |
| IN.1.7 | Secure Data Routing | FHIR allows for brokers and various forms of messaging that support assured destinations and delivery (also see IN.2.2 below) |
| IN.1.8 | Information Attestation | See the [provenance resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) |
| IN.1.9 | Patient Privacy and Confidentiality | FHIR does not include functionality related to this requirement, though implementations would be expected to provide this |
| IN.2 | Health Record Information and Management | This is a core application of the FHIR capabilities |
| IN.2.1 | Data Retention, Availability and Destruction | A FHIR RESTful server gives precise and fine-grained control of retention, availability and destruction of resources, all clearly described by the conformance statement |
| IN.2.2 | Auditable Records | FHIR provides the [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resource for auditable records. |
| IN.2.3 | Synchronization | FHIR supports synchronization using standard web publication/subscription methods via [Bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle). Bundle-based pub/sub may be push or pull based, and can include all resources of a particular type, or selected subsets of the resources. In addition, groups of resources can be exchanged in bundles, keeping a set of related resources in synchronization |
| IN.2.4 | Extraction of Health Record Information | FHIR does not provide report formats, but does provide extensive search and retrieval functions to assist with building such reports |
| IN.2.5 | Store and Manage Health Record Information | A FHIR RESTful server can store and manage health information persistently - see below for further information. |
| IN.2.5.1/2 | Manage Structured and Unstructured Health Record Information | The dual contents of FHIR resources - structured data and XHTML narrative - provide seamless support for dealing with a mix of structured and unstructured information |
| IN.3 | Registry and Directory Services | The FHIR [Administration resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html#administrative) provide a registry based access to patients, providers, etc. |
| IN.4 | Standard Terminologies and Terminology Services | FHIR encourages the use of standard terminologies wherever possible, and provides full support for their use through a variety of terminology related [data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html). FHIR defines [a terminology service infrastructure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminology-service.html). Also, see [profiling](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html), which discusses how terminology is used in a FHIR context |
| IN.5 | Standards-based Interoperability | FHIR is a definition of a standard on which to base interoperability |
| IN.5.1 | Interchange Standards | This is the core focus of FHIR. See below for discussion of interaction modes |
| IN.5.2 | Interchange Standards Versioning and Maintenance | FHIR version maintenance is [described here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#version) |
| IN.5.3 | Standards-based Application Integration | FHIR enables simple integration through use of an easy to understand, use and debug web-based infrastructure. The same framework used within an EHR for persistence can also offer a simple way to implement exchange |
| IN.5.4 | Interchange Agreements | The FHIR Conformance Statement and Resource Profile resources provide a registry based infrastructure for individual trading partner agreements, as well as for community based ones |
| IN.6 | Business Rules Management | FHIR does not address this requirement at this point in time |
| IN.7 | Workflow Management | FHIR does not address this requirement at this point in time, though the resources and services exist to support this functionality |

The EHR functional model describes several modes for interaction between systems. Each of these can be implemented in several different ways using FHIR

|  |  |
| --- | --- |
| **Interaction Modes** | **FHIR Options** |
| Unsolicited Notifications e.g. a patient has arrived for a clinic appointment | * create/update new resource via http * push resources using Bundle * Send FHIR [Message](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html) (if appropriate event is defined) |
| Query/Response e.g., Is Adam Everyman known to the system? Yes, MRN is 12345678. | * search with parameters * A query message (though not defined yet) |
| Service Request and Response e.g., Laboratory Order for Fasting Blood Sugar and a response containing the results of the test. | Could be supported either through Messaging or SOA solutions. Request/Response support is not yet defined |
| Information Interchange between organizations (e.g. in a RHIO, or in a National Health System) | * pub/sub using bundles (push or pull) * RESTful interface * FHIR messaging |
| Structured / Unstructured clinical document, e.g., dictated surgical note | See the [Documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) |

The combination of a properly secured and managed FHIR server, along with enforced use of the [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) and [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) resources ensures that the core record management functions defined in the EHR-FM are met:

* Lifespan/Lifecycle tracking, including capturing source, origination and authorship information, along with tracking of views and exchanges
* Attestation for accuracy and completeness, along with digital signature
* A full version history with content retention
* Retention and persistence

Additional functionality, not defined at this point in time in FHIR, is required to ensure non-repudiation, access control, and consent tracking.

# element-definitions.html

## Element - Detailed Descriptions

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Element

# element.html

# Element

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The base definition for all elements contained inside a resource. All elements, whether defined as a [Data Type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) (including primitives) or as part of a resource structure, have this base content:

* [Extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)
* An internal id

There are 3 kinds of descendent types that specialize Element:

* [Primitive data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#primitive), that add a primitive value property of the specified type
* [Primitive data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#complex), that add their own children (all of which are also elements)
* [BackboneElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\backboneelement.html), A specialization that adds modifierExtension, which is the super-type of all the element types defined in resource definitions (e.g. [Patient.contact](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#resource)

Note that resources themselves all specialise the base type [Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html).

## Content

* [Structure](#tabs-Element-struc)
* [UML](#tabs-Element-uml)
* [XML](#tabs-Element-xml)
* [JSON](#tabs-Element-json)
* [All](#tabs-Element-all)

**Structure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**Name**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Flags**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Card.**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Type**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Description & Constraints**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) |
| [Element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element) | I |  | [Element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element.html) | Base for all elements *All FHIR elements must have a @value or children* |
| [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id) |  | 0..1 | [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id) | xml:id (or equivalent in JSON) |
| [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension) |  | 0..\* | [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension) | Additional Content defined by implementations |
| [Documentation for this format](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | | | | |

**UML Diagram**

Element id : id 0..1 extension : Extension 0..\*

**XML Template**

<[**[name]**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element) xmlns="http://hl7.org/fhir" id="Internal id (e.g. like xml:id) ([id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id))">

<[**extension**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)><!-- **0..\*** [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension) [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#unbound) --></extension>

</[name]>

**JSON Template**

// complex types:

{

"[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id)" : "<[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id)>", // Internal Id

"[extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)" : [{// [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension)

// from Element: [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) (recursive)

"[url](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.url)" : "<[uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)>", // **R!** identifies the meaning of the extension

"[value[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.value_x_)" : <[\*](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#open)> // identifies the meaning of the extension

}]

}

// primitive types:

{

"{name}" : "value", // The primitive value

"{name}\_" : { // Special syntax for the id and extensions

"[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id)" : "<[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id)>", // Internal Id

"[extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)" : [{// [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension)

// from Element: [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) (recursive)

"[url](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.url)" : "<[uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)>", // **R!** identifies the meaning of the extension

"[value[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.value_x_)" : <[\*](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#open)> // identifies the meaning of the extension

}]

}

}

**Structure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**Name**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Flags**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Card.**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Type**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | [**Description & Constraints**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) |
| [Element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element) | I |  | [Element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element.html) | Base for all elements *All FHIR elements must have a @value or children* |
| [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id) |  | 0..1 | [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id) | xml:id (or equivalent in JSON) |
| [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension) |  | 0..\* | [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension) | Additional Content defined by implementations |
| [Documentation for this format](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#table) | | | | |

**UML Diagram**

Element id : id 0..1 extension : Extension 0..\*

**XML Template**

<[**[name]**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element) xmlns="http://hl7.org/fhir" id="Internal id (e.g. like xml:id) ([id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id))">

<[**extension**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)><!-- **0..\*** [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension) [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#unbound) --></extension>

</[name]>

**JSON Template**

// complex types:

{

"[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id)" : "<[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id)>", // Internal Id

"[extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)" : [{// [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension)

// from Element: [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) (recursive)

"[url](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.url)" : "<[uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)>", // **R!** identifies the meaning of the extension

"[value[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.value_x_)" : <[\*](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#open)> // identifies the meaning of the extension

}]

}

// primitive types:

{

"{name}" : "value", // The primitive value

"{name}\_" : { // Special syntax for the id and extensions

"[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.id)" : "<[id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id)>", // Internal Id

"[extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element.extension)" : [{// [Additional Content defined by implementations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension)

// from Element: [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) (recursive)

"[url](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.url)" : "<[uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)>", // **R!** identifies the meaning of the extension

"[value[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-definitions.html#Extension.value_x_)" : <[\*](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#open)> // identifies the meaning of the extension

}]

}

}

**Constraints**

This constraint exists to reduce syntactical variation in resource contents. If an element has no children, then it is always omitted from the resource, as opposed to optionally present without any content.

## Representation of Element

As the base type for all elements included in a resource, Element is an important structural element of FHIR. Even the primitive types inherit the base features and representation rules that apply to the Element type.

## XML Representation

Elements are represented by an XML element. The name of the element comes from the context in which it is used, not from the type. The internal id is represented as an attribute (similar to xml:id, but see below about scope). Extensions are represented as XML elements. Here is the representation for an element 'code' of type [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding):

<code id="[internal id]">

<extension url="..."/>

... if there is any extensions

<extension>

.. elements of Coding type...

</code>

Primitive types have the same representation; the actual primitive value appears as an XML attributed named value on the XML element. For example, a string property named "name" will be represented like this:

<code id="[internal id] value="[value of string]"">

<extension url="..."/>

... if there is any extensions

<extension>

</code>

## JSON Representation

Elements (except for primitive types, see below) are represented by an json object property. The name of the property comes from the context in which it is used, not from the type. The internal id is represented as a JSON string property named "\_id". Extensions are represented in a JSON array of object named "extension". Here is the representation for a property 'code' of type [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding):

{

"code" : {

"\_id" : "[internal id]",

"extension" : [

..extensions, if present...

],

.. properties of Coding type...

}

}

Primitive types are represented differently; the actual primitive value appears as a JSON string or number property. If an internal id or extensions are present, they appear in a json object with the name of the primitive value property with "\_" appended. For example, a string property named "name" will be represented like this:

{

"name" : "[value of string]",

"name\_" : {

"\_id" : "[internal id]",

"extension" : [

..extensions, if present...

]

}

}

The exact use of this pattern is [described here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html#primitive).

## Internal Id Scope

The id property of the element is defined to allow implementers to build implementation functionality that makes use of internal references inside the resource. This specification does not use the internal id on the element in any way.

The internal id is unique within the scope of the resource that contains it. Specifically, this means:

* The id SHALL be unique within a given resource
* the uniqueness boundary extends into contained resources. i.e. a contained resource cannot have the same id as any element in the resource that contains it or any other contained resource
* The uniqueness boundary is broken at Bundle.entry.resource and Parameters.parameter.resource, since these are elements that aggregate different resources

These rules ensure that there is no need to change internal identifiers while exchanging resources.

# elementdefinition-definitions.html

## Element Definition Detailed Descriptions

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### ElementDefinition

# elementdefinition-examples.html

## Element Definition Examples

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

For ElementDefinition examples, see the extensive [StructureDefinition example list](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition-examples.html).

# elementdefinition-mappings.html

## Element Definition Mappings

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page provides mappings for Element Definition.

# elementdefinition.html

# Element Definition

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The definition of an element in a resource or extension. The definition includes:

* Name, Cardinality, and data type
* Definitions, usage notes, requirements
* Default or fixed values
* Constraints, Length limits, and other usage rules
* Terminology Binding
* Mappings to other specifications
* Structural Usage Information such as [Slicing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#slicing)

The ElementDefinition type is the core of the FHIR metadata layer, and is closely (conceptually) aligned to [ISO 11179](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-mappings.html#iso11179). The [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) resource is a packaging wrapper around the ElementDefinition type. All the data elements defined in this specification are published as a collection of data elements ([XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelements.xml) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelements.json)).

## Content

**Constraints**

## Interpretation of ElementDefinition in different contexts

The data type ElementDefinition is used both in [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) and [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html), and within those resources, the way its elements are to be used and interpreted depend on the context where ElementDefinition used:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ElementDefinition field** | **DataElement** | **Base definition, first element** | **Base definition, following elements** | **Constraint Definition, first element** | **Constraint Definition, following elements** |
| name | prohibited | prohibited | prohibited | prohibited | optional, for profile re-use |
| slicing | prohibited | prohibited | prohibited | prohibited | optional |
| short/definition | optional | required | required | requiredâ€¡ | requiredâ€¡ |
| requirements/ comments/alias | optional | optional | optional | optionalâ€¡ | optionalâ€¡ |
| base | prohibited | prohibited | prohibited | required | required |
| nameReference | prohibited | prohibited | optional | prohibited | optional |
| defaultValue[x] | optional | prohibited | optional | prohibited | optionalâ€ |
| meaningWhenMissing | optional | prohibited | optional | prohibited | optionalâ€ |
| fixed[x] | prohibited | prohibited | prohibited | prohibited | optional |
| pattern[x] | optional | prohibited | prohibited | prohibited | optional |
| example[x] | optional |  | prohibited | optional | prohibited | optional |
| minValue[x] | optional | prohibited | prohibited | prohibited | optional |  |
| maxValue[x] | optional | prohibited | prohibited | prohibited | optional |  |
| maxLength | optional | prohibited | prohibited | prohibited | optional |  |
| mustSupport | optional | prohibited | prohibited | optional | optional |  |
| isModifier | prohibited | prohibited | optional | prohibited | optionalâ€ |  |
| isSummary | prohibited | prohibited | optional | prohibited | optionalâ€ |  |
| binding | optional | prohibited | optional | prohibited | optional |  |
| constraint/mapping | optional | prohibited | optional | optionalâˆ† | optionalâˆ† |  |

Notes:

* Base definition: A StructureDefinition without a base element - e.g. a definition of a structure that doesn't constrain another structure
* Constraint definition: A StructureDefinition with a base element - e.g. a definition of a structure that constrains another base structure
* â€: The element's presence, and value, must match the definition in the base structure
* â€¡: The element content must be consistent with that matching element in the base structure
* âˆ†: Additional constraints and mappings can be defined, but they do not replace the ones in the base structure

The use of Path and type depends more deeply on the context where the ElementDefinition is used:

|  |  |  |  |
| --- | --- | --- | --- |
| **Context** | **path (1st element)** | **path (following elements)** | **type (1st element)** |
| Data Element | Any token | Any token (distinct in the DataElement) | Any type |
| Base definition of a data type  (example: [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\quantity.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\quantity.profile.json.html)) | Name of the type | Path inside the datatype | Element |
| A constrained data type  (example: [Money](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Money) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\money.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\money.profile.json.html)) | Name of the base type | Path inside the datatype | Name of the base type |
| Base definition of a resource  (example: [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.profile.json.html)) | The name of the resource | Path inside the resource | DomainResource or sometimes Resource |
| Constraint on a resource  (example: [DAF Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf-patient.html) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf-patient.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf-patient.profile.json.html)) | The name of the resource | Path inside the resource  (including into the data types) | The name of the resource |
| Base Extension (a standard data type)  (example: [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#Extension) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension.profile.json.html)) | Extension | Extension.value[x] or Extension.extension | Extension |
| A defined Extension  (example: [Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-us-core-race.html) - [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-us-core-race.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-us-core-race.json.html)) | Extension | Extension.value[x] or Extension.extension (for complex extensions) | Extension |

### Rules about Slicing

* Slicing is only allowed when constraining an existing structure
* slicing can only be used on the first repeat of an element, this element is considered the slicing entry
* The first entry (the one having the slicing information) is understood to be the set of constraints to be used for the "open" slice. i.e. when the slice is open, this definition is used as a constraint on elements in the instance that are not part of a slice and belong to the open portion of the slice. Its use follows the "normal case", except:
  + slicing must be present
  + min and max govern the number of total occurrences of the sliced element including the number of occurrences in the open portion of the slice.
* An element with a cardinality of 0..1 and a choice of multiple types can be sliced by type. This is in order to specify different constraints for different types. In this case, the discriminator SHALL be "@type"

### Rules about min and max

In a [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html), min and max are always required.

In a [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html):

* **If there is no StructureDefinition.base**: min and max are always required
* Else, in StructureDefinition.differential: min and max are always optional; if they are not present, they default to the base min and max
* and in StructureDefinition.snapshot: min and max are always required

### Missing Elements

Most elements have a minimum cardinality of 0, which means that they may be missing from a resource when it is exchanged between systems. Generally, when an element is missing, all that an application processing the resource can say about the element is that the value is unknown - it may have a correct value, but it has not been provided for security or workflow reasons. On the other hand, it may not have a value at all. All the application can say is that the value is unknown.

However, for some elements, this specification makes specific rules about what it means if the element is missing. For some elements, this takes the form of a default value, a value that should be assumed if on element is present. For example, here are some default values:

|  |  |
| --- | --- |
| **Element** | **Default Value** |
| ElementDefinition.mustSupport | false |
| SampledData.factor | 1 |
| ValueSet.codeSystem.concept.abstract | false |
| List.entry.deleted | false |

Most default values are mathematical / numerical non-operations e.g false, 0 for addition or 1 for multiplication. Default values are rarely used because:

* The value must be known by all implementations
* When an element has a default value, it can never be unknown - e.g. it is implicitly mandatory
* The default value can never be changed.

For other elements, the resource explicitly documents what the meaning of a missing element is, and the meaning is not represented by a default value. Some examples:

|  |  |
| --- | --- |
| **Element** | **Meaning when missing** |
| Period.end | If the end of the period is missing, it means that the period is ongoing |
| Quantity.comparator | If there is no comparator, then there is no modification of the value |
| MedicationAdministration.wasNotGiven | If this is missing, then the medication was administered |
| Substance.instance | If this element is not present, then the substance resource describes a kind of substance |

Like default values, and for the same reasons, assigning a meaning when an element is missing is something that is not done very often. Note that Profiles cannot change the default value or missing meaning of an element, since it can't be done in the base specification either.

# extensibility-definitions.html

## Extension - Detailed Descriptions

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

# extensibility-examples.html

## Extensibility Examples

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

In order to use an extension, there is a three step process:

1. Define the extension
2. Register the extension
3. Use it in the instance

This page contains examples of how this process executes.

### Patient Consent for Record Sharing

The basic patient resource contains no information relating to patient consent, and/or the policy under which the patient consents to their registration details. A social web provider of personal healthcare record (PHR) services might be obliged to keep track of the particular policy under which a patient has created their relationship with the PHR provider, and share this with their participants via their FHIR API. If they wish, they can extend the patient resource to represent the patient's participation agreement. Note that other approaches to this problem are possible, but it suffices to demonstrate the extension process.

For the purposes of this example, we assume that the patient agrees to a participation policy as part of their sign up, and that as the provider has to change their policy, they ask patients to agree to new participation details. Each participation agreement has a URI by which it is identified, and the patient resource will carry this URI for each policy agreement that the patient has agreed to.

#### Define the Extension

For each extension, the first thing to do is to fill out the [definitional properties of the extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#define):

|  |  |
| --- | --- |
| Code | "participation-agreement" |
| Context | This extension is used in the patient resource |
| Short Defn | Agreed agreement/policy |
| Definition | A URI that identifies a participation agreement/policy to which the patient has agreed |
| Comments | URI is a literal reference to agreement text (html) |
| Cardinality | 1..\* (patient cannot participate without at least one agreement) |
| Type | uri |
| XPaths | no Invariants |
| is Modifier | No (The participation agreements do not affect that interpretation of the elements of the patient, though they will likely influence how the system interacts with the patient) |
| Binding | (No binding - not a coded value) |

#### Write the Definition of the Extension

From this table, we can build a formal extension definition. In this case, it looks like this:

<StructureDefinition xmlns="http://hl7.org/fhir">

<url value="http://example.org/fhir/StructureDefinition/participation-agreement" />

<name value="Example Extension Definition" />

<!-- snip other metadata -->

<kind value="datatype" />

<constrainedType value="Extension" />

<contextType value="resource" />

<context value="Patient" />

<differential>

<element>

<path value="Extension"/>

<short value="Agreed agreement/policy" />

<definition value="A URI that identifies a participation agreement/policy

to which the patient has agreed" />

<comments value="URI is a literal reference to agreement text (html).

Systems SHALL conform to the policies as indicated.

For further information, see the partnership agreement..." />

<mustSupport value="true" />

<isModifier value="false" />

</element>

<element>

<path value="Extension.valueUri"/>

<short value="The URI value" />

<min value="1" />

<max value="\*" />

<type>

<code value="uri" />

</type>

<mustSupport value="true" />

</element>

</differential>

</StructureDefinition>

Note that usually you would build the actual profile using some tool. This example was built by hand for this example.

#### Register the Extension

This means the profile shown above that defines the extension is placed on the web somewhere. By preference, it will be hosted in a FHIR Profile endpoint, and the best location of all is the HL7 Profile registry (yet to be implemented).

For this example, we assume that it has been uploaded to the PHR provider's own website at http://example.org/phr/documents/fhir/extensions.

#### Use it in the instance

To use the extension in an instance, the extension is placed in the root of the resource. Note that the url of the extension refers to the registered location, with the id of the extension as a fragment identifier.

<Patient xmlns="http://hl7.org/fhir">

<extension url="http://example.org/phr/documents/fhir/extensions/participation-agreement" >

<valueUri value="http://example.org/phr/documents/patient/general/v1" />

</extension>

</Patient>

#### Adding it to Patient StructureDefinition

The profile definition above simply defines the extension "participation-agreement", and says that it is used with patient. But the profile above doesn't say that the server actually uses it. For the PHR provider to indicate that all the patients resources will use this resource, a StructureDefinition on the patient resource is used:

<StructureDefinition xmlns="http://hl7.org/fhir">

<id value="patient-profile" />

<!-- snip other metadata, narrative -->

<differential>

<!-- first, the patient root element

- can be copy/paste from the base patient profile -->

<element>

<path value="Patient"/>

<!-- snip definition -->

</element>

<!-- now, the general definition for extensions

- can be copy/paste from the base patient profile,

with changes for slicing -->

<element>

<path value="Patient.extension"/>

<name value="base extension"/>

<!-- we're going to slice the extension element, and

one of the extensions is one we have defined -->

<slicing>

<!-- extension is always sliced on url -->

<discriminator value="url"/>

<!-- we don't care what the order of any extensions is -->

<ordered value="false"/>

<!-- Other extensions are allowed in addition to this one -->

<rules value="open"/>

</slicing>

<!-- snip definition -->

</element>

<!-- now, the slice that contains our extension -->

<element>

<path value="Patient.extension"/>

<!-- clone information from the extension definition.

duplicative, but this duplication makes it over all simpler -->

<short value="Agreed agreement/policy"/>

<definition value="A URI that identifies a participation agreement/policy

to which the patient has agreed"/>

<!-- min has to be 1, since the extension itself has min = 1 -->

<min value="1"/>

<max value="\*"/>

<type>

<!-- obviously it has to be an extension -->

<code value="Extension"/>

<!-- and here is the link to the extension definition:

this extension has to conform to the rules laid down in its definition -->

<profile value="http://example.org/phr/documents/fhir/extensions#participation-agreement"/>

</type>

<isModifier value="false"/>

</element>

<!-- snip the rest of the profile -->

</differential>

</StructureDefinition>

Note - this step is optional.

### Patient Name Parts

ISO 21090 (Healthcare Data Types) defines a concept called a "name part qualifier" that contains extra information about how a particular name part should be used or interpreted. In practice, this field is used rarely, except in particular cultural contexts, where certain part qualifiers are used as a matter of practice. Following the [FHIR design policy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html), such a field is not included in the overall definition of the core name data type, instead is it added as an extension.

In practice, for cases such as these in ISO 21090, HL7 provides common extensions, and these are defined at [location still to be finalized].

#### Define the Extension

For each extension, the first thing to do is to fill out the [definitional properties of the extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#define):

|  |  |
| --- | --- |
| Code | "name-qualifier" |
| Context | This extension can be used anywhere a HumanName.part appears |
| Short Defn | (one of the codes) LS | AC | NB | PR | HON | BR | AD | SP | MID | CL | IN |
| Definition | A set of codes each of which specifies a certain subcategory of the name part in addition to the main name part type |
| Comments | Used to indicate additional information about the name part and how it should be used |
| Cardinality | 0..\* (this is always optional, but more than one can be used if required) |
| Type | code |
| XPaths | N/A |
| Is Modifier | No (Qualifiers do not change the fact that the part is a given or family name) |
| RIM Mapping | ENXP.qualifier |
| v2 Mapping | N/A |
| Binding | Bound to a subset of the codes specified for [EntityNamePartQualifierR2 in ISO 21090](http://www.hl7.org/v3ballot/html/infrastructure/vocabulary/EntityNamePartQualifierR2.html) |

Not all the codes of the EntityNamePartQualifierR2 are required in this context, because prefix and suffix are explicitly part of the name types. Rather than simply refer to the OID for EntityNamePartQualifierR2 (2.16.840.1.113883.5.1122), in this case we enumerate the available codes, and set the type of the extension to code. The type of "code" is only allowed if the profile itself defines the codes that can be used. Here is a table of the codes (see the [EntityNamePartQualifierR2](http://www.hl7.org/v3ballot/html/infrastructure/vocabulary/EntityNamePartQualifierR2.html) reference for the full definitions):

|  |  |  |
| --- | --- | --- |
| LS | Legal status | For organizations a suffix... |
| AC | Academic | Indicates that a prefix like "D... |
| NB | Nobility | In Europe and Asia, there are s... |
| PR | Professional | Primarily in the British Im... |
| HON | Honorific | An honorific such as 'The Rig... |
| BR | Birth | A name that a person was given at ... |
| AD | Acquired | A name part a person acquired. ... |
| SP | Spouse | The name assumed from the partner... |
| MID | Middle Name | Indicates that the name par... |
| CL | Call me | Callme is used to indicate which... |
| IN | Initial | Indicates that a name part is ju... |

This is all then represented formally in a profile. Such profiles do not need to include constraint statements of resources; instead, they include just extension declarations and their associated bindings. In this case, the definition looks like this:

<StructureDefinition xmlns="http://hl7.org/fhir">

<url value="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" />

<name value="iso-21090 Name Qualifier" />

<!-- snip other metadata, including definition of RIM Mapping -->

<kind value="datatype" />

<constrainedType value="Extension" />

<contextType value="datatype" />

<context value="HumanName.given" />

<context value="HumanName.prefix" />

<context value="HumanName.family" />

<context value="HumanName.suffix" />

<differential>

<element>

<path value="Extension"/>

<short value="LS | AC | NB | PR | HON | BR | AD | SP | MID | CL | IN" />

<definition value="A set of codes each of which specifies a certain subcategory

of the name part in addition to the main name part type" />

<comments value="Used to indicate additional information about the

name part and how it should be used" />

<mustSupport value="false" />

<isModifier value="false" />

</element>

<element>

<path value="Extension.value"/>

<short value="LS | AC | NB | PR | HON | BR | AD | SP | MID | CL | IN" />

<min value="0" />

<max value="\*" />

<type>

<code value="code" />

</type>

<binding>

<strength value="required" />

<description value="A set of codes each of which specifies a certain subcategory

of the name part in addition to the main name part type" />

<valueSetReference>

<reference value="ValueSet/name-part-qualifier" />

</valueSetReference>

</binding>

<mapping>

<identity value="RIM" />

<map value="ENXP.qualifier" />

</mapping>

</element>

</differential>

</StructureDefinition>

Note that usually you would build the actual profile using some tool. This example was built from a spreadsheet definition by the FHIR build tooling.

#### Register the Extension

For this example, it is registered at <http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier>. This is the url that will appear in the definition element when the extension is used.

#### Use it in the instance

To use the extension in an instance, the extension is nested within the attribute that is extended. Note that the url of the extension refers to the registered location, with the id of the extension as a fragment identifier.

<name>

<use value="official" />

<given value="Ã–stlund">

<extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >

<valueCode value="MID" />

</extension>

</given>

</name>

This particular example is a Scandinavian mellannamn. See [Datatypes examples for additional examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes-examples.html).

### Complex Extension: Patient Clinical Trial

Defining complex extensions is a little different. They have the same meta data - context etc, but differ in the internal structure. As an example, consider enrolling a patient in a clinical trial. There are 3 data items to collect:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Code** | **Name** | **Cardinality** | **Type** | **Content** |
| NCT | Clinical Trial number | 1..1 | string | The format for the US ClinicalTrials.gov registry number is â€œNCTâ€ followed by an 8-digit number, e.g.: NCT00000419 |
| period | trialPeriod | 0..1 | Period | The start and end times of the participation of this patient in the clinical trial |
| reason | reason enrolled | 0..1 | CodableConcept | indication or reason the patient is part of this trial |

Like simple extensions, the first thing to do is to assign a URI to the extension. Since this one is part of the FHIR publication, it is assigned a URI where it will be published: http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial.

Internally, in the extension, the cardinality of the value[x] element is set to 0, since it will not (and cannot) be used. Then, the Extension.extension element is sliced by url, and 3 slices are defined, each with a fixed relative URI which is the code from the table above. Here's the relevant parts of the definition of this extension:

<StructureDefinition xmlns="http://hl7.org/fhir">

<!-- metadata - setting up the base definition -->

<url value="http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial"/>

<name value="The patient's participation in clinical trials"/>

<constrainedType value="Extension"/>

<contextType value="resource"/>

<context value="Patient"/>

<base value="http://hl7.org/fhir/StructureDefinition/Extension"/>

<snapshot>

<element>

<path value="Extension"/>

<!-- etc -->

</element>

<!-- set up the slicing -->

<element>

<path value="Extension.extension"/>

<slicing>

<discriminator value="url"/>

<ordered value="true"/>

<rules value="openAtEnd"/>

</slicing>

</element>

<!-- first slice, NCT -->

<element>

<path value="Extension.extension"/>

<name value="NCT"/>

<short value="National Clinical Trial number"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Extension.extension.extension"/>

<min value="0"/>

<max value="0"/> <!-- not allowed to be used -->

</element>

<element>

<path value="Extension.extension.url"/>

<min value="1"/>

<max value="1"/>

<fixedUri value="NCT"/>

</element>

<element>

<path value="Extension.extension.valueString"/>

<min value="1"/>

<max value="1"/>

<type>

<code value="string"/>

</type>

</element>

<!-- second slice, period -->

<element>

<path value="Extension.extension"/>

<name value="period"/>

<short value="The period of participation in the clinical trial"/>

<min value="0"/>

<max value="1"/>

</element>

</element>

<element>

<path value="Extension.extension.extension"/>

<min value="0"/>

<max value="0"/>

</element>

<element>

<path value="Extension.extension.url"/>

<min value="1"/>

<fixedUri value="period"/>

</element>

<element>

<path value="Extension.extension.valuePeriod"/>

<type>

<code value="Period"/>

</type>

</element>

<!-- third slice, reason -->

<element>

<path value="Extension.extension"/>

<name value="reason"/>

<short value="The reason for participation in the clinical trial"/>

<min value="0"/>

<max value="1"/>

</element>

<element>

<path value="Extension.extension.extension"/>

<min value="0"/>

<max value="0"/>

</element>

<element>

<path value="Extension.extension.url"/>

<min value="1"/>

<fixedUri value="reason"/>

</element>

<element>

<path value="Extension.extension.valueCodeableConcept"/>

<type>

<code value="CodeableConcept"/>

</type>

</element>

<!-- last (for order reasons): the fixed URI -->

<element>

<path value="Extension.url"/>

<fixedUri value="http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial"/>

</element>

<!-- and no value in the root -->

<element>

<path value="Extension.value[x]"/>

<min value="0"/>

<max value="0"/>

</element>

</snapshot>

</StructureDefinition>

# extensibility-registry.html

## Extension Registry

All extensions defined under http://hl7.org/fhir/StructureDefinition/. Additional extensions may be registered on the HL7 FHIR registry at <http://fhir.org/registry>.

Implementation Guides that define extensions: .

# extensibility.html

# Extensibility

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This exchange specification is based on generally agreed common requirements across healthcare - covering many jurisdictions, domains, and different functional approaches. It is common for specific implementations to have valid requirements that are not part of these agreed common requirements. Incorporating all of these requirements would make this specification very cumbersome and difficult to implement. Instead, this specification expects that these additional distinct requirements will be implemented as extensions.

As such, extensibility is a fundamental part of the design of this specification. Every element in a resource may have extension child elements to represent additional information that is not part of the basic definition of the resource. Applications should not reject resources merely because they contain extensions, though they may need to reject resources because of the specific contents of the extensions.

Note that, unlike in many other specifications, there can be no stigma associated with the use of extensions by any application, project, or standard - regardless of the institution or jurisdiction that uses or defines the extensions. The use of extensions is what allows the FHIR specification to retain a core simplicity for everyone.

In order to make the use of extensions safe and manageable, there is a strict governance applied to the definition and use of extensions. Though any implementer is allowed to define and use extensions, there is a set of requirements that must be met as part of their use and definition.

## Extension Element

Every element in a resource or data type includes an optional "extension" child element that may be present any number of times. This is the content model of the extension as it appears in each resource:

Notes:

* The *url* is a mandatory attribute / property and identifies a retrievable [extension definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) that defines the content and meaning of the extension.
* An extension SHALL have either a value (i.e. a value[x] element) or sub-extensions, but not both. If present, the value[x] element SHALL have content (value attribute or other elements)
* If it is not safe for an application processing the content of the resource to ignore the extension it must be represented diffferently, using [a Modifier Extension](#isModifier)
* The *value[x]* element has an actual name of "value" and then the TitleCased name of one of these defined types, and its contents are those as defined for that type:
  + [Integer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer)
  + [Decimal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#decimal)
  + [DateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime)
  + [Date](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#date)
  + [Instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#instant)
  + [String](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#string)
  + [Uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)
  + [Boolean](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#boolean)
  + [Code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) (only if the extension definition provides a [fixed](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#code) binding to a suitable set of codes)
  + [markdown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#markdown)
  + [Base64Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#base64Binary)
  + [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding)
  + [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept)
  + [Attachment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment)
  + [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier)
  + [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity)
  + [Range](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range)
  + [Period](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period)
  + [Ratio](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Ratio)
  + [HumanName](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName)
  + [Address](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address)
  + [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint)
  + [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing)
  + [Signature](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature)
  + [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference) - a reference to another resource

Here is an example of an extension in XML:

<name>

<extension url="http://hl7.org/fhir/StructureDefinition/iso-21090-name-use" >

<valueCode value="I" />

</extension>

<text value="Chief Red Cloud"/>

</name>

In this example, the name with text = "Chief Red Cloud" is extended to have a name use code of "Indigenous" (defined in ISO 21090, but very rarely used in practice).

In JSON, extensions are represented similarly:

"name" : {

"extension" : [{

"url" : "http://hl7.org/fhir/StructureDefinition/iso-21090-name-use",

"valueCode" : "I"

}],

"text" : "Chief Red Cloud"

}

Making the types explicit in the representation means that all systems can read and write (and therefore store and/or exchange) extensions correctly without needing to access the definition of the extension.

Note that the JSON represenation for extensions on primitive data types is handled differently. See [Representing primtive types in JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html#primitive) for further information.

Extensions can also contain extensions, either because the extension definition itself defines complex content - that is, a nested tree of values in the extension, or because the extension is extended with an additional extension defined separately.

In the first case, the identity of the parts of the extension are local/relative to the reference to the extension definition.

As an example, consider extending a patient with an opt-in status for a clinical trial, with 3 fields: clinical trial number, period of involvement, and a reason for enrollment. In XML:

<Patient>

<extension url="http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial" >

<extension url="NCT" >

<valueString value="123456789" />

</extension>

<extension url="period" >

<valuePeriod>

<start value="2009-03-14" />

</valuePeriod>

</extension>

<extension url="reason" >

<valueCodeableConcept>

<coding>

<system value="http://acme.org/codes/general" />

<code value="tt14j" />

</coding>

</valueCodeableConcept>

</extension>

</extension>

<!-- other data for patient -->

</Patient>

Or in JSON:

{

"resourceType" : "Patient",

"extension" : [{

"url" : "http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial",

"extension" : [{

"url" : "NCT",

"valueString" : "123456789"

}, {

"url" : "period",

"valuePeriod" : {

"start" : "2009-03-14"

}

}, {

"url" : "reason",

"valueCodeableConcept" : {

"coding" : {

"system" : "http://acme.org/codes/general",

"code" : "tt14j",

}

}

}]

}]

... other data for patient ...

}

As the URL suggests, [this extension is defined as part of this specification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-patient-clinicaltrial.html).

This can be extended again, by adding a "registrar" extension:

The registrar is defined as a separate extension (e.g. by an implementing organization), rather than part of the official clinical-trial extension. The url of the extension is different:

<Patient>

<extension url="http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial" >

<extension url="NCT" >

<valueString value="123456789" />

</extension>

<extension url="period" >

<valuePeriod>

<start value="2009-03-14" />

</valuePeriod>

</extension>

<extension url="reason" >

<valueCodeableConcept>

<coding>

<system value="http://acme.org/codes/general" />

<code value="tt14j" />

</coding>

</valueCodeableConcept>

</extension>

</extension>

<extension url="http://acme.org/fhir/StructureDefinition/registrar" >

<valueReference>

<reference value="Practitioner/example" />

</valueReference>

</extension>

<!-- other data for patient -->

</Patient>

or in JSON:

{

"resourceType" : "Patient",

"extension" : [{

"url" : "http://hl7.org/fhir/StructureDefinition/patient-clinicalTrial",

"extension" : [{

"url" : "NCT",

"valueString" : "123456789"

}, {

"url" : "period",

"valuePeriod" : {

"start" : "2009-03-14"

}

}, {

"url" : "reason",

"valueCodeableConcept" : {

"coding" : {

"system" : "http://acme.org/codes/general",

"code" : "tt14j",

}

}

},{

"url" : "http://acme.org/fhir/StructureDefinition/registrar",

"valueReference" : {

"reference" : "Practitioner/example"

}

}]

}]

... other data for patient ...

}

## Modifier Extensions

There are some cases where the information provided in extensions modifies the meaning of the element that contains it. Typically, this means information that qualifies or negates the primary meaning of the element that contains it. Some examples:

* An anti-prescription: recording an instruction **not** to take a medication
* Using the [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) resource to record an assertion that a patient has a family history of the condition rather than the condition itself
* Asserting that a performer was **not** actually involved in a [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html)
* Asserting an additional subsumption relationship on a concept in a [value set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html)

Implementers should avoid the use of modifier extensions where possible. Any use should be carefully considered against its possible downstream consequences. However, implementers are often forced into these situations by the business arrangements around the use of resources, so this specification creates a framework for handling these cases. If modifier extensions are present, an application cannot safely process the resource unless it knows what the extension means for its own use of the data.

This specification allows for such modifier elements to be included at the base of a resource or in any elements that do not have a data type (e.g. the elements that correspond to classes in the resource UML diagrams). Elements that are data types, or that are inside data types SHALL NOT have modifier extensions.

In XML, these modifier elements are represented using an element named "modifierExtension", which has same content as the *extension* element documented above:

Example: There's no element on [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) to write an "anti-prescription" - an instruction not to take a medication for a particular time. Classical clinical recording systems do not record this as a prescription - but one particular system does, and these "anti-prescription" records need to be shared within the institution where this happens, as they are an important part of the workflow. Hence, applications are allowed to extend a resource with data like this:

<MedicationOrder>

<modifierExtension url="http://example.org/fhir/StructureDefinition/anti-prescription">

<valueBoolean value="true"/>

</modifierExtension>

<!-- ... other content ... -->

</MedicationOrder>

Or in JSON:

{

"resourceType" : "MedicationOrder",

"modifierExtension" : [{

"url" : "http://example.org/fhir/StructureDefinition/anti-prescription",

"valueBoolean" : "true"

}],

.. other content ...

}

Implementations processing the data in resources SHALL check for modifiers anywhere they may appear, and if a modifier extension is present, SHALL do one of these things:

1. understand the impact of the extension when using the data
2. refuse to process the data
3. carry a warning concerning the data along with any action or output that results from processing the data to inform users that it has not fully understood the source information

Processing the data of a resource typically means copying or filtering data out of a resource for use in another context (display to a human, decision support, exchange in another format where not all information is included, or storing it for this kind of use). Servers and background processes that simply move whole resources around unchanged are not "processing the data of the resource", and therefore these applications are not required to check for unknown modifier extensions.

**#1**: When an application understands this extension, it means that some developer has provided appropriate instructions for what to do with the data contained in it because of the existence of the modifier extension.

**#2**: This means that implementations are not inherently required to "support" a modifier extension in any meaningful way - they may achieve this understanding by rejecting instances that contain this extension (a server, for instance, could return a HTTP 422 status code with an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) if a client PUTs or POSTs a modifier extension it does not know. Applications may also be able to ignore a modifier extension if they can know that this is safe to do in its own context, though this would not usually be the case.

Note that implementations may be able to be sure, due to their implementation environment (e.g. specific trading partner agreement), that modifier extensions will never occur, and can therefore meet the requirement to check for modifiers at the design stage. However, since integration and deployment options often change subsequently, applications SHOULD always check for modifier extensions when processing resources anyway.

**#3**: One way to warn the user is to download the extension definition from the given URL, and then use the defined display name to present the extension to the user. An error message could look something like this:

Note that the narrative of the resource SHALL contain this qualifying information, so it is safe to show this to the user as an expression of the resource's content. A warning dialog box could be extended to offer the user the choice to see the original narrative.

Here is the prescription example from above with narrative:

<MedicationOrder xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

<p><b>Note: This prescription is an instruction NOT to take a medication</b></p>

<!-- snip actual narrative -->

</div>

</text>

<!-- ...data... -->

<modifierExtension url="http://example.org/fhir/StructureDefinition/anti-prescription">

<valueBoolean value="true"/>

</modifierExtension>

<!-- ...data... -->

</MedicationOrder>

An application only needs to concern itself with modifierExtensions on elements that it processes. Take, for example, the case above where a procedure resource has a modifierExtension on one of the performer elements indicating that they did not participate in the procedure. In this case, if an application is not using the performer details at all, the fact that one of the performers has a modifierExtension is irrelevant and the application is free to ignore it. If it does process the performers, and it sees the modifier extension, it must act in one of the ways outlined above.

### Summary: Conformance Rules for Modifier Extensions

* Modifier Extensions SHALL only modify the element which contains it and/or that element's children
* It SHALL always be safe to show the narrative to humans; any modifier extension SHALL be represented in the narrative
* Applications SHALL always check for modifier extensions when processing the data from any element that may carry one
* If a modifier Extension they do not understand is present, the application SHALL either refuse to process the resource or affected element, or provide an appropriate warning to its users

### Special Case: Missing data

In some cases, implementers may find that they do not have appropriate data for an element with minimum cardinality = 1. In this case, the element must be present, but unless the resource or a profile on it has made the actual value of the primitive data type mandatory, it is possible to provide an extension that explains why the primitive value is not present:

<uri>

<extension url="http://hl7.org/fhir/StructureDefinition/data-absent-reason">

<valueCode="unknown"/>

</extension>

</uri>

In this example, instead of a value, a [data missing code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\general-extensions.html) is provided. Note that it is not required that this particular extension be used. This extension is **not** a modifier extension, because the primitive data type has no value.

It is not valid to create a fictional piece of data for the primitive value, and then to add an extension indicating that the data has been constructed to meet the data rules. This would be both a bad idea, and also a modifier extension, which is not allowed on data types.

## Exchanging Extensions

Extensions are a way of allowing local requirements to be reflected in a resource using a common information based approach so that all systems can confidently process them using the same tools. However, when it comes to processing the information, applications will be constrained in their ability to handle extensions by the degree to which they are informed about them.

While the structured definition of an extension should always be available (see below for details), the mere availability of a definition does not automatically mean that applications know how to handle them correctly - generally, human decisions are required to be made around how the data in extensions contain should be handled, along with the implicit obligations that surround the information.

For this reason, local requirements that manifest as extensions are an obstacle to integration. The more the requirements are shared (i.e. regional or national scale), the less impact they will have. The consistent representation, definition and registration of extensions that this specification defines cannot resolve that problem - it only provides a framework within which such local variations can be handled more easily.

When it comes to deploying applications that support local requirements, situations will very likely arise where different applications exchanging information with each other are supporting different sets of extensions. This specification makes some basic rules that are intended to make management of these situations easier, but they cannot resolve them.

* When exchanging resources, systems SHOULD retain unknown extensions when they are capable of doing so (just as they SHOULD retain core elements when they are capable of doing so)
* If a system modifies a resource it SHOULD remove any extensions that it does not understand from the modified element and its descendants, because it cannot know whether the modifications it has made might invalidate the value of the unknown extension
* Systems that drop existing elements are considered to be "processing the resource"
* A system SHALL NOT modify a resource or element that contains "modifier" extensions it doesn't understand
* Applications SHOULD ignore extensions that they do not recognize if they are not "modifier" extensions
* Systems that do not accept unknown extensions SHALL declare so in their Conformance resource instances

The degree to which a system can retain unknown extensions is a function of the type of system it is: a general purpose FHIR server, or a middleware engine would be expected to retain all extensions, while an application that manages patient registration through a user interface can only retain extensions to the degree that the information in them is part of the set managed by the user. Other applications will fall somewhere between these two extremes.

### Summary: Handling extensions

Use the following rules as a guideline for handling resources:

* When writing extensions, make sure they are defined and published
* When reading, navigating through or searching on elements that can have modifier extensions, check whether there are any
* When reading elements, read and process the extensions you know and use, and ignore other extensions
* Retain extensions whenever you can

# financial.html

## Financial Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The table below details various common business activities which occur in the financial realm, and the focal resources which may be exchanged, along with supporting resources, to accomplish the business activities. Whether or not the resources specified are actually needed requires consideration of the business itself and the exchange methodology and transport being used.

For example, if a definitive 'Request' does not need to be documented and communicating parties are using REST then a GET may be used in place of a CREATE of the request resource. Alternately, if FHIR Operations are being used then the specified focal resource may not be required or may be employed as one of the Operation parameters.

**Note:** The SupportingDocumentation resource has been deprecated in favour of DocumentManifest for the excahnge of attachments and supporting materials, PDF, Images, XRays, etc.

|  |  |  |
| --- | --- | --- |
| **Business Activity** | **Request Resource** | **Response Resource** |
| Eligibility Check | [EligibilityRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityrequest.html) | [EligibilityResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityresponse.html) |
| Enrollment Update | [EnrollmentRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentrequest.html) | [EnrollmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentresponse.html) |
| Claim | [Claim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) (type={discipline}, use=complete) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Pre-determination | [Claim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) (type={discipline}, use=exploratory) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Pre-Authorization | [Claim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) (type={discipline}, use=proposed) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Reversal | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=cancel, nullify=false) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Nullify | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=cancel, nullify=true) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Re-adjudication | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=reprocess) | [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) |
| Status Check | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=status) | [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html) |
| Pended Check (Polling) | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=poll) | [{Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html)} or [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html) |
| Payment Notice | [PaymentNotice](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentnotice.html) | [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html) |
| Payment Reconciliation | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=poll, include=[PaymentReconciliation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentreconciliation.html)) | [PaymentReconciliation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentreconciliation.html) |
| Send Attachments | [DocumentManifest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentmanifest.html) | [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html) |
| Request an Explanation of Benefits | [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) (action=poll, include=[ExplanationOfBenefit](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\explanationofbenefit.html)) | [ExplanationOfBenefit](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\explanationofbenefit.html) |

**{disipline}** means the type of claim: OralHealth, Vision, Pharmacy, Professional or Institutional.

**{Resource}** means any pended or undelivered resource subject to the selection details specified in the request.

|  |  |  |
| --- | --- | --- |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |

Additional Resources will be added in the future. A list of hypothesized resources can be found on the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR_Resource_Types). Feel free to add any you think are missing or engage with one of the [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm) to submit a [proposal](http://wiki.hl7.org/index.php?title=Category:FHIR_Resource_Proposal) to define a resource of particular interest.

# footer.html

**Warning: FHIR is a draft specification that is still undergoing development prior to balloting as a full HL7 standard**   
Implementers are welcome to experiment with the content defined here, but should note that the contents are subject to change without prior notice.  
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# footer1.html

**Warning: FHIR is a draft specification that is still undergoing development prior to balloting as a full HL7 standard**   
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# footer2.html

**Warning: FHIR is a draft specification that is still undergoing development prior to balloting as a full HL7 standard**   
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# footer3.html

**Warning: FHIR is a draft specification that is still undergoing development prior to balloting as a full HL7 standard**   
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# formats-definitions.html

## Resource Format - Detailed Descriptions

# formats-examples.html

## Resource Format Examples

This page includes additional examples of the resource format, based on common usages and questions

Todo

# formats.html

# Resource Formats

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page documents how the content of the resources are described. In actual exchange, resources can be represented in the following formats: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) and [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html). Other representations are allowed, but are not described by this specification.

## Resource Definition

The resources are described in several different ways:

* a hierarchical table that presents a logical view of the content
* a UML diagram that summarizes the content graphically
* a pseudo-XML syntax that provides a visual sense of what the end resource instances will look like in XML
* a pseudo-JSON syntax that provides a visual sense of what the end resource instances will look like in JSON

In addition to this descriptive syntax, other definitional forms are available, including W3C schema and Schematron, and the [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) syntax defined internally.

### Logical table

The Logical View shows the resources as a tree structure with the following columns:

|  |  |
| --- | --- |
| **Column** | **Content** |
| Name | The name of the element in the resource (manifests as XML element name, or JSON property name. Some names finish with "[x]" - the meaning of this is discussed below. In addition, this column contains an icon that denotes the underlying type of the content. The icons are described below |
| Flags | A set of information about the element that impacts how implementers handle them. The flags are described below |
| Card. | The lower and upper bounds on how many times this element is allowed to appear in the resource |
| Type | The type of the element (hyperlinked to the definition of the type) |
| Description & Constraints | A description of the element, and details about constraints that are applied to it. Particularly, for coded elements, information about which codes can be used |

Here's an example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Flags** | **Card.** | **Type** | **Description & Constraints** |
| Resource Name |  |  | [Base Type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html) | Definition |
| nameA | Î£ | 1..1 | type | description of content |
| nameB[x] | ?! Î£ | 0..1 |  | description SHALL at least have a value |
| nameBType1 |  | 0..1 | type1 |  |
| nameBType2 | I | 0..1 | type2 |  |
| nameC |  | 1..\* | Element | Definition |
| nameD |  | 1..1 | type | Relevant Records |

Key to Type Icons and Flags

* : The base element for a resource (see [Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html))
* : An element that is part of the resource and has elements within it defined in the same resource or profile
* : An element which can have one of a several different types (see below)
* : A data type which describes an element that has a value attribute/property
* : A data type which describes an element that has other elements
* : A element that contains a reference to another resource (see [references](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html))
* : This element has the same content as another element defined within this resource or profile
* : Introduction of a set of slices (see [Slicing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#slicing))
* : An extension (see [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html))
* : A complex extension - one with nested extensions (see [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#complex))
* : An extension that has a value and no nested extensions (see [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html))
* : The root of a logical profile
* ?!: This element is a modifying element - see [Modifier Elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#isModifier)
* S: This element is an element that must be supported - see [Must-Support Elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#mustSupport)
* Î£: This element is an element that is part of the summary set - see [Summary Searches](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#summary)
* I: This element defines or is affected by constraints - see [Constraints](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#constraints)
* NE: This element cannot have extensions (some infrastructural elements only)

Notes:

* Resource and Element names are case-sensitive (though duplicates that differ only in case are never defined)
* Any elements that have a [primitive type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#primitive) will have a "value" attribute/property to contain the actual value of the element
* This "value" attribute/property can never be empty. Either it is absent, or it is present with at least one character of non-whitespace content
* Elements are assigned a cardinality that specifies how many times the element may or must appear.
* Unless elements have children defined directly (as nameC does above) they are assigned one or more types. Most of the types are defined in [the data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html). All the type names are hyperlinked to the source definition
* Element reuse: Some data types that have children have the same set of children as some other element defined in the resource. In that case, the type of that element has a "see [name]" where [name] is the name of the element that has the defined children
* Each element name is also a hyperlink to the formal definition of the element in the data dictionary that underlies the exchange formats.
* Any of the elements may have an id attribute to serve as [the target of an internal reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#id). The id attribute is not shown in this format. Extensions are not always shown, but may appear except where the flag "NE" appears
* FHIR elements can never be empty. If an element is present in the resource, it SHALL have either a value, child elements as defined for its type, or 1 or more [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)
* Infrastructural elements that are common to all resources are not shown in the logical representation. These are described in the common base classes [Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html), and [DomainResource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\domainresource.html)

### Choice of Data Types

A few elements have a choice of more than one type for their content. All such elements have a name that takes the form nnn[x]. The "nnn" part of the name is constant, and the [x] is replaced with the title-cased name of the type that is actually used. The table view shows each of these names explicitly.

All elements that have a choice of data type have a maximum cardinality of 1. There can only be one element for type, of one of the allowed data types.

Note: In object-orientated based implementations, this is naturally represented as a polymorphic property. However this is not necessary, and the correct implementation varies according to the particular features of the language. In XML schema, these become an xs:choice of element.

### UML

The UML diagrams represent the same content as a series of classes that represent the elements of a resource.

NameA element : [type] [0..\*] nameB : CodeableConcept [0..1] Â« Value Set Name? Â» NameC value[x] : Type [0..1] Â« Type1|Type2|Type3 Â» reference : Reference [0..1] Â« Resource1|Resource2 Â» nameC [0..1]

The elements and types are links to the formal definitions of the parts. The UML diagrams also show the bindings, and these are hyperlinks to the value set details.

Where an element can have a choice of data types, or is a [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html) these are represented by showing the common type ("Reference" or "Type"), and then showing the applicable type names or resource types in a stereotype, separated by the "|" character. "Type" is not formally otherwise defined by this specification, but is a super type of all the data types.

The actual order of the elements in XML cannot be determined from the diagram, nor whether a UML property becomes an element or an attribute in the XML representation.

### Wire Format Representations

This specification defines these ways to represent resources when they are exchanged:

* [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html)
* [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)
* [RDF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rdf.html) *(Under development)*

Clients and servers can choose whether to implement in XML or JSON. In the interests of interoperability, Servers SHOULD support both formats. Systems SHALL declare which format(s) they support in their [Conformance Statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html). If a server receives a request for its conformance statement in a format it does not otherwise support, it SHALL return a 415 Unsupported Media Type.

# header.html

# help.html

## Documentation Assistance And Glossary

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

On this page:

* Ballot Status Help
* Glossary
* Documentation Style Guidelines

# history.html

See [below](#history) for version history details.

## Version History

This is the developmental version of FHIR. The only changes tracked here are changes from after the publication of the DSTU. For changes from before this, see the [DSTU #1 Version History](http://hl7.org/fhir/history.html). Note that a full archive history of everything is available [through the HL7 gForge SVN archives](http://wiki.hl7.org/index.php?title=FHIR).

### How FHIR Versioning works

The FHIR version policy is based on [Semantic versioning](http://semver.org/), but with some differences due to fact that FHIR is a specification, not a software API.

There is a single development version of FHIR. This undergoes cycles of development as managed by HL7. Each major cycle of development is concluded by a formal ballot, and then a new specification is published. In version control terms, each published specification is a branch off the development trunk, which may then itself undergo further change as HL7 maintains the published specification (though such changes are usually extremely minimal).

The following kinds of changes may be made to the specification:

* Non-substantiative changes do not cause changes in any conformant application. For example, section renumbering, broken links, style corrections, typos, and clarifications that do not change the meaning. Some corrections may be judged not to create any expectation of change to a conformant application
* Substantiative changes that are not breaking. These introduce new functionality - changes to the specification that create new capabilities, but would not render existing applications non-conformant if they do not change
* Breaking changes would mean that previously conformant applications are not longer conformant

Note that the following are, by definition, considered non-breaking changes, even though some implementations (including the reference implementations) may not be able to handle some consequences of these changes without error:

* creation of new resources
* adding new elements in an existing resource
* defining new datatypes
* Adding new API operations

Also, the examples are never substantiative - every effort is made to ensure that they are correct, but changes to the examples in the specification are not considered substantiative.

Each FHIR version is identified by a string composed from 4 parts: publication.major.minor.revision.

|  |  |
| --- | --- |
| publication | * Incremented when HL7 publishes FHIR as an updated specification, e.g. a DSTU or normative version of FHIR * HL7 plans to do this every 1 to 2 years * The first DSTU was version 0 |
| major | * Increments every time a breaking change is made * When a new publication is made, this is reset to 0 in the publication, and 1 in the development branch * Since HL7 does not make breaking changes as technical corrections to a published specification, these versions of FHIR always have a version number X.0.n.r * Because the development version is the subject of ongoing analysis, debate, ballot and repeated alterations, breaking changes are to be expected |
| minor | * Increments every time a substantive change is made * Resets to 0 any time the major version changes |
| revision | * Incremented any time a change is made to the specification * At present, this is the SVN version number (this allows anyone to reconstruct the source from which the version was built from) |

Additional notes:

* Changes to a formally published specification (except for minor publishing corrections, such as correcting broken links) are only made via announced technical corrections
* The reference implementations have 2 versions - the version of the specification that they implement, and their own version. Consult the reference implementation documentation for policy regarding this version number
* The specification published by the continuous integration service (<http://hl7-fhir.github.io/>) build may not conform to this version policy, but the versions published on the HL7 web site will (see [Directory of published versions](http://hl7.org/fhir/directory.html))
* The first DSTU was published prior to these rules being agreed as v0.80-2286. This has been updated to 0.0.81.2382 as a technical correction to align with this policy on 9-May 2014

### Version History since DSTU #1

This table lists substantiative changes only.

|  |  |
| --- | --- |
| **Version** | **Changes** |
| 1.0.0 | **DSTU QA Preview, Aug 31, 2015**  This version had extensive change as a result of the May DSTU ballot, ongoing testing, and the open change proposals (over 800 gForge tasks). Howe extensive the changes were is best illustrated by the size of the [list of changes labelled 'breaking change'](http://wiki.hl7.org/index.php?title=FHIR_Breaking_changes_between_DSTU_2_ballot_and_final) - 158 changes of 1317 total tasks. This is a list of the most important changes:   * General: introduced the [maturity framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity) * [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html): add batch, several clarifications around versioning & transactional integrity, changed Bundle URL resolution rules * [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html): changed the way <> etc works, added \_list parameter, changed rules around contained and included resources * Formats: added a [note about whitespace in XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html), added [code generation schemas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html#schema-gen) * Data Types:   + New data types: [markdown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#markdown), [Annotation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation),   + changed data types: [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity), [Signature](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature), [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing), [Address](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address), [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint)   + changes to [ElementDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html): add base, make type.profile repeat, remove invariant.name and replace with invariant.requirements, remove binding.name, add min/max value * Resources:   + New resources: [Account](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\account.html), [ImplementationGuide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementationguide.html), [TestScript](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\testscript.html)   + renamed: contraindication -> [DetectedIssue](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\detectedissue.html), MedicationPrescription -> [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html), QuestinnaireAnswers -> [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html)   + removed: Supply   + changed: almost all resources - too many to list (1300+ tasks worth of changes) - add, remove elements, change types, references, definitions & value sets, re-order elements, provide much more documentation and new examples * Implementation Guide:   + Add [Clinical Quality Improvement Framework (CQIF)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\cqif\cqif.html)   + Move [Argonaut content](http://argonautwiki.hl7.org/index.php?title=Main_Page) out |
| 1.0.0 | **DSTU Ballot, May 2015**  This version had extensive change as a result of the January Draft ballot, ongoing testing, and the open change proposals (over 800 gForge tasks). List here is a summary of the major changes to resource content, but this is only a small amount of the overall changes.  **Enumerations**   * All spaces removed * Extensive content changes not noted here   **New Data Types**   * [unsignedInt](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#unsignedInt) * [positiveInt](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#positiveInt) * [Signature](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Signature) * [Meta](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#Meta)   **Changed Data Types**   * [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) - remove valueSet * [Attachment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment) - add creation * [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) - replace label with type * [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing) - major rework of content * [ElementDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html) - add label, code, rename 'formal' to definition, rename synonym to alias, add language to mapping, remove conformance and isExtensible and replace with strength   **New Resources**   * [BodySite](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bodysite.html) * [Claim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) * [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html)   **Removed Resources**   * CarePlan2 -> collapsed into CarePlan * FamilyHistory -> broken up into FamilyMemberHistory * InstitutionalClaim, OralHealthClaim, PharmacyClaim, ProfessionalClaim, VisionClaim -> collapsed into Claim * Other - use Basic instead * PendedRequest,Readjudicate, Reversal, StatusRequest, StatusResponse - use ProcessRequest/Response instead * SupportingDocumentation - use DocumentManifest instead   **Renamed Resources**   * Alert -> Flag: 'alert' made people think it was an action like an alarm * SecurityEvent -> AuditEvent: it wasn't just for security purposes * ClinicalAssessment -> ClinicalImpression: people got confused with 'assessment' tools like APGAR score * Profile -> StructureDefinition: 'Profile' is the process, a package of statements   **Changes Inside Resources**   * [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) - allow parameter.part to contain a resource * [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) - rename subject to patient * [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html) - remove lastModifiedBy/lastModified, add location * [AppointmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointmentresponse.html) - remove lastModifiedBy/lastModified, add rename individual to actor * [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) - add .event.purposeOfEvent, participant.location, .policy, and .purposeOfUse * [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) - major reorganization * [CarePlan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html) - pull goal out + other reorganization * [ClinicalImpression](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinicalimpression.html) - add status, replace careplan & referral with trigger, rename diagnosis to finding, make plan 0..\*, * [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) - change .section.content to refer to List only, not any * [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) - change identifier to url, add useContext, change telecom to contact, * [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) - rename subject to patient, rename status to clinicalStatus, change to bodySite = code or Reference(BodySite), rename .codeableConcept to .code * [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) - change identifier to url, add useContext, change telecom to contact, add requirements and copyright, add support for conditional operations, * [Contract](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\contract.html) - extensive rewrite * [Coverage](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\coverage.html) - add bin, subscriberId * [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) - total rewrite to use ElementDefinition * [Device](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\device.html) - add status, manufactureDate * [DeviceMetric](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\devicemetric.html) - rename operationalState to operationalStatus, add measurementMode, rename calibrationInfo to calibration, change color to an enumerations * [DeviceUseRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceuserequest.html)/[DeviceUseStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceusestatement.html) - change to bodySite = code or Reference(BodySite) * [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) - change to bodySite = code or Reference(BodySite) * [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) - add encounter * [DocumentManifest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentmanifest.html) - add options for how content is referred to * [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) - add format, remove policyManager, make content : Attachment, and remove several related attributes, remove service reference and add context.practiceSetting, sourcePatientInfo, and related * [Encounter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter.html) - add incomingReferralRequest, allow reason to repeat, rename diet to dietPreference * [EpisodeOfCare](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\episodeofcare.html) - rename currentStatus to status, allow referralRequest to repeat, * [Flag](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\flag.html) - rename subject to patient, change from note to code * [Goal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\goal.html) - add targetDate, statusDate, author, priority * [HealthcareService](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\healthcareservice.html) - extensive rewrite * [ImagingObjectSelection](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingobjectselection.html) - remove retrieveAETitle, rename retrieveUrl to url, add frames * [ImagingStudy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingstudy.html) - add laterality, change url to attachment * [Immunization](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\immunization.html) - add encounter, rename subject to patient, rename refusedIndicator to wasNotGiven, rename refusalReason to reasonNotGiven * [ImmunizationRecommendation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\immunizationrecommendation.html) - rename subject to patient * [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html) - add title, status, change ordered to orderedBy, add note * [Location](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\location.html) - remove status * [Media](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\media.html) - remove created (-> Attachment) * [Medication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication.html) - add batch * [MedicationAdministration](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationadministration.html) - add reasonGiven, note, text. remove timing & maxDosePerPeriod * [MedicationDispense](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationdispense.html) - collapse to a single dispense, add daysSupply, note and substitution, change quantity to allow range * [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) - add note, change quantity to allow range, * [MedicationStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationstatement.html) - add informationSource, status, dateAsserted, replace whenGiven with effective[x], remove device, add dosage.text * [NamingSystem](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\namingsystem.html) - add date, publisher, * [NutritionOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\nutritionorder.html) - extensive rewrite * [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) - change name to code, allow more types of value[x], change type of dataAbsentReason, change to bodySite = code or Reference(BodySite), allow identifier to repeat, add device, * [OperationDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) - change identifier to url, add useContext, change telecom to contact, change name to title, add reuqirements, idempotent, * [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) - change type of .issue.type * [OrderResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\orderresponse.html) - rename code to orderStatus * [Organization](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization.html) - remove location and contact.gender * [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) - communication to allow 'preferred' * [Person](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\person.html) - rename other to target * [Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html) - change type of birthDate, allow multiple roles per practitioner * [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html) - add status and category, change to bodySite = code or Reference(BodySite), allow date to be period too, add location, change followUp to code 0..\*, add device tracking * [ProcedureRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedurerequest.html) - change to bodySite = code or Reference(BodySite) * [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) - change integritySignature to signature & make it a type, allow reference by Reference as well as URI * [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) - add telecom * [Schedule](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\schedule.html) - move lastModified * [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) - change telecom to contact, add status, experimental, date, * [Slot](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\slot.html) - move lastModified * [Specimen](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\specimen.html) - change source to parent, change to bodySite = code or Reference(BodySite) * [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) - complete rewrite * [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html) - change type of tag, reanme url to endPoint, * [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) - change identifier to url, add useContext, change telecom to contact, replace purpose with useContext, add requirements, rename stableDate to lockedDate, change type of expansion.identifier, add expansion parameters |
| 0.4.0 | **Draft For Comment, January 2015 Ballot**  Breaking Changes (full list):   * Replace atom and taglist with a native [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) format ([3728](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3728), [3558](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3558), [2889](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=2889)) (and also [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\binary.html)) * JSON: change how extensions are represented ([3471](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3471)) * RESTful API: change how version specific upgrades work ([3451](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3451)) * DataTypes: * Rename Schedule to [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing) ([3536](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3536), [3236](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3236)) * Rename Contact to [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint) ([3533](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3533)) and swap order of elements ([3108](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3108))) * [Address](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address) - change zip to postCode ([2888](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=2888)) * [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity): Correct schema spelling for "QuantityCompararator" ([3531](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3531)) * Change allowable values for the [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id) type to include capital letters, and allow up to 64 chars ([3750](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3750)) * Restructure [Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profile.html) - only one structure, and pull [ExtensionDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) out of Profile (3647, 3498), and pull [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) out ([3626](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3626)) * [Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profile.html): allow 0..\* discriminator ([3131](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3131)), and change the way discriminators work across resource boundaries ([3124](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3124)) + generate multiple types properly ([2856](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=2856)) * remove \_validate interaction, and replace with $validate operation ([3686](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3686)) * [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html): separate birth time from birthDate ([3731](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3731)), Change Administrative Gender from a CodableConcept to a Code. Also fixed the values as male|female|other|unknown with mappings to v2 and v3 ([3070](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3070)) * [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html): change encoding of Hash to Base64 ([3291](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3291)) * [Group](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\group.html): rename header to title ([3126](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3126)) * [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html): split relatedItem into two ([3111](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3111)) * [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html): drop questionnaire.group.question.remarks ([3255](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3255)) and move omitReason from extension to base resource ([3260](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3260)) * [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html): allow multiple answers ([3146](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3146)) * [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html): replace ValueSet.compose.include.code with ValueSet.compose.include.concept ([3258](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3258)), added new rules about expansion content ([3138](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3138)) * [Media](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\media.html): Rename element 'dateTime' to 'created' ([3174](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=3174)) and length to duration ([2866](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=2866)) * Remove DeviceObservationReport and Query * Collapse AdverseReaction into [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) * [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html) changes - individual field renamed to actor, and added mappings to v2 and v3 * [FamilyMemberHistory](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\familymemberhistory.html) combined with [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html) replaces FamilyHistory (with corresponding updates to related profiles) * [Flag](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\flag.html) replaces Alert including improved clarification of how it is used and replacement of "note" with "code" * [CarePlan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html) significantly refactored including splitting Goal out as a distinct resource, moving elements between activity and detail, introduction of several new elements and supported relationship types   New Resources:   * [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html) * [AppointmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointmentresponse.html) * [Basic](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\basic.html) * [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) * [ClinicalImpression](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinicalimpression.html) * [Communication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\communication.html) * [CommunicationRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\communicationrequest.html) * [Contract](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\contract.html) * [Contraindication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\contraindication.html) * [Coverage](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\coverage.html) * [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) * [DeviceComponent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\devicecomponent.html) * [DeviceMetric](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\devicemetric.html) * [DeviceUseRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceuserequest.html) * [DeviceUseStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceusestatement.html) * [EligibilityRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityrequest.html) * [EligibilityResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityresponse.html) * [EnrollmentRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentrequest.html) * [EnrollmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentresponse.html) * [EpisodeOfCare](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\episodeofcare.html) * [ExplanationOfBenefit](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\explanationofbenefit.html) * [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) * [Goal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\goal.html) * [HealthcareService](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\healthcareservice.html) * [ImagingObjectSelection](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingobjectselection.html) * [InstitutionalClaim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [NamingSystem](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\namingsystem.html) * [NutritionOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\nutritionorder.html) * [OperationDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) * [OralHealthClaim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [PaymentNotice](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentnotice.html) * [PaymentReconciliation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentreconciliation.html) * [Person](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\person.html) * [PharmacyClaim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [ProcedureRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedurerequest.html) * [ProfessionalClaim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html) * [ReferralRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\referralrequest.html) * [RiskAssessment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\riskassessment.html) * [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) * [Schedule](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\schedule.html) * [Slot](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\slot.html) * [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html) * SupportingDocumentation * [VisionClaim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) * [VisionPrescription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\visionprescription.html)   New Implementation Guides (see [discussion of status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\iglist.html))   * [Argonaut Project](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\argonaut\argonaut.html) * [Data Access Framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html) * [Structured Data Capture](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\sdc\sdc.html) & [Structured Data Capture - Data Element Exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\sdcde\sdcde.html) * US Laboratory [Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\uslab\uslaborder.html), [Report](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\uslab\uslabreport.html) & [Report to Public Health](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\uslab\uslabphreport.html) * [EHRS Functional model - Record Lifecycle Events](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ehrsrle\ehrsrle.html) |
| 0.3.0 | * Renamed Namespace to NamingSystem * Split [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html) from [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) and significantly revamped the [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) in response to feedback from the Connectathon. * Added [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) resource (has been previously discussed as ObservationDefinition) * Defined [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html) resource for evaluation * Add [time](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#time) data type * Define RPC-type [operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) on the RESTful interface, and add [Operation Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) * Defined operations on several resources including [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html), [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) and [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) * [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html): Change Conformance.rest.operation to Conformance.rest.interaction and Conformance.rest.resource.operation to Conformance.rest.resource.interaction, and add Conformance.rest.operation to point to [Operation Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) * [Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profile.html): add Profile.url, Profile.structure.snapshot and Profile.structure.differential, and remove query definition (now in OperationDefinition) * Add pages for [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html), [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html), and [SNOMED CT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html) * Significant rework for [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) so it can be used to map between structures as well as value sets * Add [Contraindication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\contraindication.html) and [Risk Assessment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\riskassessment.html) and added examples to other resources in support of these * Add [Referral Request](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\referralrequest.html) * Add supportingInformation to [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) * Add fulfills to [Encounter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter.html) * Add date and age[x] to [FamilyHistory](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\familymemberhistory.html) * Change cardinality of [Location](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\location.html).identifier to 0..\* * Change cardinality of [Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html).address to 0..\* * Add [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html).encounter to 0..\* * Temporarily added content for the [Structured Data Capture implementation guide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\sdc\sdc.html), including profiles on several resources, conformance instances, etc. This content will be moved to an external specification once the necessary tooling is in place to support that form of publication. |
| 0.2.1 | * Minor new optional elements on value set for metadata, new extensions for all the rest of the VSD project metadata, formal profile to express basic minimum metadata for value set |
| **0.2.0** | * Namespace: adjustments based on Grahame's feedback |
| 0.1.0 | * Add [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html), [Appointment Response](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointmentresponse.html), [Schedule](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\schedule.html) and [Slot](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\slot.html) * Add *Namespace* |

Note: a useful tool for displaying the differences between pages is the [W3C HTML Diff engine](http://services.w3.org/htmldiff).

# http.html

## RESTful API

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Each resource type has the same set of interactions defined that can be used to manage the resources in a highly granular fashion. Applications claiming conformance to this framework claim to be conformant to "RESTful FHIR" (see [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html)).

Note that in this RESTful framework, transactions are performed directly on the server resource using an HTTP request/response. The API does not directly address authentication, authorization, and audit collection - for further information, see the [Security Page](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html).

The API describes the FHIR resources as a set of operations (known as "interactions") on resources where individual resource instances are managed in collections by their type. Servers can choose which of these interactions are made available and which resource types they support. Servers SHALL provide a [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) that specifies which interactions and resources are supported.

The following logical interactions are defined:

|  |  |
| --- | --- |
| **Instance Level Interactions** |  |
| [read](#read) | Read the current state of the resource |
| [vread](#vread) | Read the state of a specific version of the resource |
| [update](#update) | Update an existing resource by its id (or create it if it is new) |
| [delete](#delete) | Delete a resource |
| [history](#history) | Retrieve the update history for a particular resource |
| **Type Level Interactions** | |
| [create](#create) | Create a new resource with a server assigned id |
| [search](#search) | Search the resource type based on some filter criteria |
| [history](#history) | Retrieve the update history for a particular resource type |
| **Whole System Interactions** | |
| [conformance](#conformance) | Get a conformance statement for the system |
| [batch/transaction](#transaction) | Update, create or delete a set of resources in a single interaction |
| [history](#history) | Retrieve the update history for all resources |
| [search](#search) | Search across all resource types based on some filter criteria |

In addition to these interactions, there is an [operations framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html), which includes endpoints for [validation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operation-resource-validate.html), [messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html#mailbox) and [Documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html#bundle).

**Style Guide**

The interactions on this page are defined like this:

VERB [base]/[type]/[id] {?\_format=[mime-type]}

* The first word is the HTTP verb used for the interaction
* Content surrounded by [] is mandatory, and will be replaced the string literal identified. Possible insertion values:
  + **base**: The [Service Root URL](#root)
  + **mime-type**: The [Mime Type](#mime-type)
  + **type**: The name of a resource type (e.g. "Patient")
  + **id**: The [Logical Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#id) of a resource
  + **vid**: The [Version Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) of a resource
  + **compartment**: The name of a [compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment)
  + **parameters**: URL parameters as defined for the particular interaction
* Content surrounded by {} is optional

Implementations constructing URLs using these patterns SHOULD conform to [RFC 3986 Section 6 Appendix A](https://tools.ietf.org/html/rfc3986#appendix-A) which requires percent-encoding for a number of characters that occasionally appear in the URLs (mainly in search parameters).

This specification uses the undescore as a prefix to disambiguate reserved names from other names in 3 cases:

* To differentiate system wide history and search interactions from interactions on Resource Types
* To differentiate search, history etc interactions from instances of a resource type
* To differentiate search parameters defined for all reosurces from those defined for specific resource types

In addition, the character "$" is used as a prefix to operation names that are RPC-like additions to the base API defined, either by this specification or by implementers.

### Service Root URL

The Service Root URL is the address where all of the resources defined by this interface are found. The Service Root URL takes the form of

http(s)://server{/path}

The path portion is optional, and does not include a trailing slash. Each resource type defined in this specification has a manager (or "entity set") that lives at the address "/[type]" where the "type" is the name of the resource type. For instance, the resource manager for the type "Patient" will live at:

https://server/path/Patient

All the logical interactions are defined relative to the service root URL. This means that if the address of any one FHIR resource on a system is known, the address of other resources may be determined.

Note: All URLs (and ids that form part of the URL) defined by this specification are case sensitive.

Note that a server may use a path of the form "http://server/...[xx]..." where the [xx] is some variable portion that identifies a particular instantiation of the FHIR API. Typically, the variable id identifies a patient or a user, and the underlying information is completely compartmented by the logical identity associated with [xx]. In this case, the FHIR API presents a patient or user centric view of a record, where authentication/authorization is explicitly granted to the URL, on the grounds that some identifiable user is associated with the logical identity. It is not necessary to explicitly embed the patient id in the URL - implementations can associate an FHIR end-point with a particular patient or provider by using an OAuth login. See [Compartments](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartments) for the logical underpinning.

**Identity**

Systems often need to compare two URLs to determine whether they refer to the same URL or not. For the purposes of this specification, the following rules apply:

* The query part of the URL (anything after '?') is ignored
* The comparison of the document portion of the URL (i.e. not the server/port) is case sensitive
* http: and https: are exchangeable and refer to the same object
* If a port is specified, then the ports must be identical or the objects are different (due to the prevalence of port mapping and/or interface engines running on different ports). Ports should only be explicit when they have explicit meaning to the server

For example: http://myserver.com/patient/1 and https://myserver.com/patient/1 are the same, while http://myserver.com:81/patient/1 is distinct from either of the above. This does not mean that the two addresses need to be treated the same, or that a server must serve both addresses, but just that these two addresses have the same identity, and if both are served, they must both represent the same real world object. Systems are not required to check that this is true. Note: the identity comparison for protocols other than http/https is undefined.

### Resource Metadata and Versioning

Each resource has an associated set of [resource metadata elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata). These map to the http request and response using the following fields:

|  |  |
| --- | --- |
| **Metadata Item** | **Where found in HTTP** |
| [Logical Id (.id)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#id) | The Id is represented explicitly in the URL |
| [Version Id (.meta.versionId)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) | The Version Id is represented in the ETag header |
| Last modified (.meta.lastUpdated) | HTTP Last-Modified header |

Note that the Version Id is considered a "weak" ETag and ETag headers should be prefixed with "W/" and enclosed in quotes, for example:

ETag: W/"3141"

### Security

Using HTTPS is optional, but all production exchange of healthcare data SHOULD use SSL and additional security as appropriate. See [HTTP Security](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#http) for further information. Most operations will require user authentication, and all operations that do are subject to [RBAC](https://en.wikipedia.org/wiki/Role-based_access_control) and/or [ABAC](https://en.wikipedia.org/wiki/Attribute-based_access_control), and some operations may depend on appropriate consent being granted.

The choice of whether to return 403 (Unauthorised) or 404 (Not found) depends upon the specific situation and specific local policies, regulations, and laws. The decision of which error to use will include consideration of whether disclosure of the existence of relevant records is considered an acceptable disclosure of PHI (Personal Health Information) or a prohibited disclosure of PHI. Note that since a 404 does not leak information, it should be the default choice unless there is a specific reason to return a 403.

Note: to support browser-based client applications, recommend that servers SHOULD implement [cross-origin resource sharing](http://enable-cors.org/) for the interactions documented here. Experience shows that this is an area where ongoing issues may be expected as security holes are found and closed in an ongoing basis.

### HTTP Status Codes

This specification makes rules about the use of specific HTTP status codes in particular circumstances where the status codes SHALL map to particular states correctly, and only where the correct status code is not obvious. Other HTTP status codes may be used for other states as appropriate, and this particularly includes various authentication related status codes and redirects. Authentication redirects should not be interpreted to change the location of the resource itself (a common web programming error).

FHIR defines an [OperationOutcome resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) that can be used to convey specific detailed processable error information. For a few combinations of interactions and specific return codes, an OperationOutcome is required to be returned as the content of the response. The OperationOutcome may be returned with any HTTP 4xx or 5xx response, but is not required - many of these errors may be generated by generic server frameworks underlying a FHIR server.

### Managing Return Content

In the interests of managing band-width, this specification allows clients to specify what kind of content to return.

#### conditional read

Clients may use the If-Modified-Since, or If-None-Match HTTP header on a read request. If so, they MUST accept either a 304 Not Modified as a valid status code on the response (which means that the content is unchanged since that date) or full content (either the content has not changed, or the server does not support conditional request).

Servers can return 304 Not Modified where content is unchanged since the If-Modified-Since date-time or the If-None-Match ETag specified or they can return the full content as normal. This optimisation is relevant in reducing bandwidth for caching purposes and servers are encouraged but not required to support this. If servers don't support conditional read, they just return the full content.

#### create/update/transaction

These interactions are performed using POST,PUT and POST respectively, and it may be appropriate for a server to return either only a status code, or also return the entire resource that is the outcome of the create or update (which may be different to that provided by the client). In the case of transactions this means returning a Bundle with just the Bundle.entry.response populated for each entry, and not the Bundle.entry.resource values.

The client can indicate whether the entire resource is returned using the [HTTP return preference](https://tools.ietf.org/html/rfc7240#section-4.2):

Prefer: return=minimal

Prefer: return=representation

The first of these two asks to return no body. The second asks to return the full resource. Servers SHOULD honour this header. In the absence of the header, servers may chose whether to return the full resource or not. Note that this setting only applies to succesful interactions. In case of failure, servers SHOULD always return a body that contains an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource.

### Content Types and encodings

The formal MIME-type for FHIR resources is application/xml+fhir or application/json+fhir. The correct mime type SHALL be used by clients and servers:

* XML: **application/xml+fhir**
* JSON: **application/json+fhir**

Servers SHALL support server-driven content negotiation as described in [section 12](http://www.w3.org/Protocols/rfc2616/rfc2616-sec12.html#sec12) of the HTTP specification.

However in order to support various implementation limitations, servers SHOULD support the optional \_format parameter to specify alternative response formats by their MIME-types. This parameter allows a client to override the accept header value when it is unable to set it correctly due to internal limitations (e.g. XSLT usage). For the \_format parameter, the values "xml", "text/xml", "application/xml", and "application/xml+fhir" SHALL be interpreted to mean the normative XML format defined by FHIR and "json", "application/json" and "application/json+fhir" SHALL be interpreted to mean the informative JSON format. In addition, the values "html" and "text/html" are allowed.

FHIR uses UTF-8 for all request and response bodies. Since the HTTP specification (section 3.7.1) defines a default character encoding of ISO-8859-1, requests and responses SHALL explicitly set the character encoding to UTF-8 using the charset parameter of the MIME-type in the Content-Type header. Requests MAY also specify this charset parameter in the Accept header and/or use the Accept-Charset header.

Note: the \_format parameter does not override the content-type header.

The content types application/x-www-form-urlencoded is also accepted for posting SEARCH requests.

### Support for Versions

Servers that support this API SHOULD provide full version support - that is, populate and track versionId correctly, support vread, and implement [version aware updates](#versionaware). Supporting versions like this allows for related systems to track the correct version of information, and to keep integrity in clinical records. However, many current operational systems do not do this, and cannot easily be re-engineered to do so.

For this reason, Servers are allowed to not provide versioning support: this API does not enforce that they are supported. Clients may elect to only interact with servers that do provide full versioning support. Systems declare their support for versioning in their [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-definitions.html#Conformance.rest.resource.noVersion).

Server should always return the default timezone for [date searches](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#date) in the HTTP Response headers using the Date header. Note: Servers are not required to have a default timezone.

### read

The read interaction accesses the current contents of a resource. The interaction is performed by an HTTP GET command as shown:

GET [base]/[type]/[id] {?\_format=[mime-type]}

This returns a single instance with the content specified for the resource type. This url may be accessed by a browser. The possible values for the [Logical Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#id) (id) itself are described in the [id type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id). The returned resource SHALL have an id element with a value that is the [id]. Servers SHOULD return an ETag header with the versionId of the resource (if versioning is supported) and a Last-Modified header.

Note: Unknown resources and deleted resources are treated differently on a read: A GET for a deleted resource returns a 410 status code, whereas a GET for an unknown resource returns 404. Systems that do not track deleted records will treat deleted records as an unknown resource. Since deleted resources may be brought back to life, servers MAY include an ETag on the error response when reading a deleted record to allow version contention management when a resource is brought back to life.

In addition, the search parameter \_summary can be used when reading a resource:

GET [base]/[type]/[id] {?\_summary=text}

This requests that only a subset of the resource content be returned, as specified in the \_summary parameter, which can have the values [true, false, text & data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#summary). Note that a resource that only contains a subset of the data is not suitable for use as a base to update the resource, and may not be suitable for other uses. Servers SHOULD use the [SUBSETTED](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\SecurityIntegrityObservationValue\index.html#SUBSETTED) [Security Label](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) to explicitly mark such resources.

### vread

The vread interaction preforms a version specific read of the resource. The interaction is performed by an HTTP GET command as shown:

GET [base]/[type]/[id]/\_history/[vid] {?\_format=[mime-type]}

This returns a single instance with the content specified for the resource type for that version of the resource. The returned resource SHALL have an id element with a value that is the [id], and a meta.versionId element with a value of [vid]. Servers SHOULD return an ETag header with the versionId (if versionning is supported) and a Last-Modified header.

The [Version Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) (vid) is an opaque identifier that conforms to the same [format requirements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id) as a [Logical Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#id). The id may have been found by performing a history interaction (see below), by recording the version id from a content location returned from a read or from a version specific reference in a content model. If the version referred to is actually one where the resource was deleted, the server should return a 410 status code.

Servers are encouraged to support a version specific retrieval of the current version of the resource even if they do not provide access to previous versions. If a request is made for a previous version of a resource, and the server does not support accessing previous versions, it should return a 404 Not Found error, with an operation outcome explaining that history is not supported for the underlying resource type.

### update

The update interaction creates a new current version for an existing resource or creates an initial version if no resource already exists for the given id. The update interaction is performed by an HTTP PUT command as shown:

PUT [base]/[type]/[id] {?\_format=[mime-type]}

The request body SHALL be a [Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html) with an id element that has an identical value to the [id] in the URL. If no ID element is provided, or the value is wrong, the server SHALL respond with a HTTP 400 error code, and SHOULD provide an operation outcome identifying the issue. If the request body includes a [meta](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta), the server SHALL ignore the existing versionId and lastUpdated values. If the server supports versions, it SHALL populate the meta.versionId and meta.lastUpdated with the new correct values. Servers are allowed to review and alter the other metadata values, but SHOULD refrain from doing so (see [metadata description](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta) for further information).

A server SHOULD accept the resource as submitted when accepts the update, and return the same content when it is subsequently read. However systems may not be able to do this; see the note on [transactional integrity](#transactional-integrity) for discussion. Also, see [Variations between Submitted data and Retrieved data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\updates.html) for additional discussion around update behavior.

**DSTU Note:** The update operation updates the entire resource. Servers MAY apply some logic and preserve some existing content based where this is known to be appropriate behavior. HTTP PATCH functionality is likely to be defined, and feedback from outcomes of implementer experimentation is welcome.

Feedback [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

If the interaction is successful, the server SHALL return either a 200 OK HTTP status code if the resource was updated, or a 201 Created status code if the resource was created, with a Last-Modified header, and an ETag header which contains the new versionId of the resource. If the resource was created (i.e. the interaction resulted in a 201 Created), the server SHOULD return a Location header (this is for HTTP conformance; it's not otherwise needed).

Note: Servers MAY choose to preserve XML comments, instructions, and formatting or JSON whitespace when accepting updates, but are not required to do so. The impact of this on digital signatures may need to be considered.

Note that servers MAY choose to allow clients to PUT a resource to a location that does not yet exist on the server - effectively, allowing the client to define the id of the resource. Whether a server allows this is a deployment choice based on the nature of its relationships with the clients. While many servers will not allow clients to define their ids, there are several reasons why it may be necessary in some configurations:

* client is reproducing an existing data model on the server, and needs to keep original ids in order to retain ongoing integrity
* Client is a server doing push based pub/sub (this is a special case of the first reason)
* multiple clients doing push in the context of agreed data model shared across multiple servers where ids are shared across servers

Alternatively, clients may be sharing an agreed identification model (e.g. key server, scoped identifiers, or UUIDs) where clashes do not arise.

Servers can choose whether or not to support client defined ids, and indicate such to the clients using [Conformance.rest.resource.updateCreate](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-definitions.html#Conformance.rest.resource.updateCreate).

#### Rejecting Updates

Servers are permitted to reject update interactions because of integrity concerns or other business rules, and return HTTP status codes accordingly (usually a 422).

Common HTTP Status codes returned on FHIR-related errors (in addition to normal HTTP errors related to security, header and content type negotiation issues):

* **400 Bad Request** - resource could not be parsed or failed basic FHIR validation rules (or multiple matches were found for
* **403 Not Authorised** - authorization is required for the interaction that was attempted
* **404 Not Found** - resource type not supported, or not a FHIR end point
* **405 Method Not allowed** - the resource did not exist prior to the update, and the server does not allow client defined ids
* **409/412** - version conflict management - see [below](#concurrency)
* **422 Unprocessable Entity** - the proposed resource violated applicable FHIR profiles or server business rules

Any of these errors should be SHOULD be accompanied by an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource providing additional detail concerning the issue.

For additional information on how systems may behave when processing updates, refer to the [Variations between Submitted data and Retrieved data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\updates.html) page.

#### Conditional update

The conditional update interaction allows a client to update an existing resource based on some identification criteria, rather than by [logical id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta). To accomplish this, the client issues a PUT as shown:

PUT [base]/[type]/?[search parameters]

When the server processes this update, it performs a search using its standard [search facilities](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) for the resource type, with the goal of resolving a single logical id for this request. The action it takes depends on how many matches are found:

* **No matches**: The server performs a [create](#create) interaction
* **One Match**: The server performs the update against the matching resource
* **Multiple matches**: The server returns a 412 Precondition Failed error indicating the the client's criteria were not selective enough

This variant can be used to allow a stateless client (such as an interface engine) to submit updated results to a server, without having to remember the logical ids that the server has assigned. For example, a client updating the status of a lab result from "preliminary" to "final" might submit the finalized result using PUT /Observation?identifier=http://my-lab-system|123

Note that transactions and conditional create/update/delete are complex interactions and it is not expected that every server will implement them. Servers that don't support the conditional update should return an HTTP 400 error and an operation outcome.

### Managing Resource Contention

[Lost Updates](http://www.w3.org/1999/04/Editing/), where two clients update the same resource, and the second overwrites the updates of the first, can be prevented using a combination of the [ETag](http://www.w3.org/Protocols/rfc2616/rfc2616-sec14.html#sec14.19) and [If-Match](http://www.w3.org/Protocols/rfc2616/rfc2616-sec14.html#sec14.24) header.

To support this usage, servers SHOULD always return an ETag header with each resource:

HTTP 200 OK

Date: Sat, 09 Feb 2013 16:09:50 GMT

Last-Modified: Sat, 02 Feb 2013 12:02:47 GMT

ETag: W/"23"

Content-Type: application/json+fhir

if provided, the value of the ETag SHALL match the value of the version id for the resource. Servers are allowed to generate the version id in whatever fashion that they wish, so long as they are valid according to the [id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#id) data type, and are unique within the address space of all versions of the same resource. When resources are returned as part of a bundle, there is no ETag, and the versionId of the resource is used directly.

If the client wishes to request a version aware update, it submits the request with an If-Match header that quotes the ETag from the server:

PUT /Patient/347 HTTP/1.1

If-Match: W/"23"

If the version id given in the If-Match header does not match, the server returns a 409 Conflict status code instead of updating the resource.

Servers can require that clients provide an If-Match header by returning 412 Pre-condition failed status codes when no If-Match header is found.

### delete

The delete interaction removes an existing resource. The interaction is performed by an HTTP DELETE command as shown:

DELETE [base]/[type]/[id]

A delete interaction means that subsequent [non-version specific reads](#read) of a resource return a 410 HTTP status code and that the resource is no longer found through [search](#search) interactions. Upon successful deletion, or if the resource does not exist at all, the server should return 204 (No Content).

Whether to support delete at all, or for a particular resource type or a particular instance is at the discretion of the server based on the business rules that apply in its context. If the server refuses to delete resources of that type as a blanket policy, then it should return the 405 Method not allowed status code. If the server refuses to delete a resource because of reasons specific to that resource, such as referential integrity, it should return the 409 Conflict status code. Performing this interaction on a resource that is already deleted has no effect, and the server should return a 204 or 200 response. Resources that have been deleted may be "brought back to life" by a subsequent [update](#href) interaction using an HTTP PUT.

Many resources have a status element that overlaps with the idea of deletion. Each resource type defines what the semantics of the deletion interactions are. If no documentation is provided, the deletion interaction should be understood as deleting the record of the resource, with nothing about the state of the real-world corresponding resource implied.

For servers that maintain a version history, the delete interaction does not remove a resource's version history. From a version history respect, deleting a resource is the equivalent of creating a special kind of history entry that has no content and is marked as deleted.

Since deleted resources may be brought back to life, servers MAY include an ETag on the delete response to allow version contention management when a resource is brought back to life.

#### Conditional delete

The conditional delete interaction allows a client to update an existing resource based on some selection criteria, rather than by a specific [logical id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta). To accomplish this, the client issues an HTTP DELETE as shown:

DELETE [base]/[type]/?[search parameters]

When the server processes this update, it performs a search as specified using the standard [search facilities](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) for the resource type. The action it takes depends on how many matches are found:

* **No matches**: The server returns 404 (Not found)
* **One Match**: The server performs an ordinary delete on the matching resource
* **Multiple matches**: Servers may choose to delete all the matching resources, or it may choose to return a 412 Precondition Failed error indicating the the client's criteria were not selective enough. A server indicates whether it can delete multiple resources in its [Conformance Statement (.rest.resource.conditionalDelete)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-definitions.html#Conformance.rest.resource.conditionalDelete). if there are multiple matches, either all must deleted, or the server SHALL return an error

This variant can be used to allow a stateless client (such as an interface engine) to delete a resource on a server, without having to remember the logical ids that the server has assigned. For example, a client deleting a lab atomic result might delete the resource using DELETE /Observation?identifier=http://my-lab-system|123.

Note that transactions and conditional create/update/delete are complex interactions and it is not expected that every server will implement them. Servers that don't support the conditional delete should return an HTTP 400 error and an operation outcome.

### create

The create interaction creates a new resource in a server-assigned location. If the client wishes to have control over the id of a newly submitted resource, it should use the [update](#update) interaction instead. The create interaction is performed by an HTTP POST command as shown:

POST [base]/[type] {?\_format=[mime-type]}

The request body SHALL be a FHIR Resource without an id element (this is the only case where a resource exists without an id element). If an ID element is provided, the server SHALL respond with a HTTP 400 error code, and SHOULD provide an operation outcome identifying the issue. If the request body includes a [meta](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta), the server SHALL ignore the existing versionId and lastUpdated values. The server SHALL populate the meta.versionId and meta.lastUpdated with the new correct values. Servers are allowed to review and alter the other metadata values, but SHOULD refrain from doing so (see [metadata description](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta) for further information).

A server SHOULD accept the resource as submitted when it accepts the create, and return the same content when it is subsequently read. However some systems may not be able to do this; see the note on [transactional integrity](#transactional-integrity) for discussion.

The server returns a 201 Created HTTP status code, and SHOULD also return a Location header which contains the new [Logical Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) and [Version Id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) of the created resource version:

Location: [base]/[type]/[id]/\_history/[vid]

where [id] and [vid] are the newly created id and version id for the resource version. Servers SHOULD return an ETag header with the versionId (if versioning is supported) and a Last-Modified header.

When the resource syntax or data is incorrect or invalid, and cannot be used to create a new resource, the server returns a 400 Bad Request HTTP status code. When the server rejects the content of the resource because of business rules, the server returns a 422 Unprocessible Entity error HTTP status code. In either case, the server SHOULD include a response body containing an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) with detailed error messages describing the reason for the error.

Common HTTP Status codes returned on FHIR-related errors (in addition to normal HTTP errors related to security, header and content type negotiation issues):

* **400 Bad Request** - resource could not be parsed or failed basic FHIR validation rules
* **404 Not Found** - resource type not supported, or not a FHIR end point
* **422 Unprocessable Entity** - the proposed resource violated applicable FHIR profiles or server business rules. This should be accompanied by an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource providing additional detail

Note: Servers MAY choose to preserve XML comments, instructions, and formatting or JSON whitespace when accepting creates, but are not required to do so. The impact of this on digital signatures may need to be considered.

For additional information on how systems may behave when processing updates, refer to the [Variations between Submitted data and Retrieved data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\updates.html) page.

#### Conditional create

The conditional create interaction allows a client to create a new resource only if some equivalent resource does not already exist on the server. The client defines what equivalence means in this case by supplying a FHIR search query in an If-None-Exist header as shown:

If-None-Exist: [search parameters]

The parameter just contains the search parameters (what would be in the URL following the "?").

When the server processes this update, it performs a search as specified using its standard [search facilities](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) for the resource type. The action it takes depends on how many matches are found:

* **No matches**: The server processes the create as above
* **One Match**: The server ignore the post and returns 200 OK
* **Multiple matches**: The server returns a 412 Precondition Failed error indicating the the client's criteria were not selective enough

This variant can be used to avoid the risk of two clients creating duplicate resources for the same record. For example, a client posting a new lab result might specify If-None-Exist: identifier=http://my-lab-system|123 to ensure it is does not create a duplicate record.

Note that transactions and conditional create/update/delete are complex interactions and it is not expected that every server will implement them. Servers that don't support the conditional create should return an HTTP 412 error and an operation outcome.

### search

This interaction searches a set of resources based on some filter criteria. The interaction can be performed by several different HTTP commands.

GET [base]/[type]{?[parameters]{&\_format=[mime-type]}}

This searches all resources of a particular type using the criteria represented in the parameters.

Because of the way that some user agents and proxies treat GET and POST requests, in addition to the get based search method above, servers that support *search* SHALL also support a POST based search:

POST [base]/[type]/\_search{?[parameters]{&\_format=[mime-type]}}

This has exactly the same semantics as the equivalent GET command. All these search interactions take a series of parameters that are a series of name'='value pairs encoded in the URL (or as an application/x-www-form-urlencoded submission for a POST). (See [W3C HTML forms](http://www.w3.org/TR/REC-html40/interact/forms.html#form-content-type)).

Note: application/x-www-form-urlencoded is supported for POST so that invoking a search by GET or POST can be done from HTML forms in a browser (though considerable active content might be required in the browser), although this is not the main usage.

Searches are processed as specified for the [Search handling mechanism](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html).

If the search fails (cannot be executed, not that there is no matches), the return value is a status code 4xx or 5xx with an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html). If the search succeeds, the return content is a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle) with [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) = searchset containing the results of the search as a list of resources in a defined order. The result list can be long, so servers may use paging. If they do, they SHALL use the method [described below](#paging) (adapted from [RFC 5005 (Feed Paging and Archiving](https://tools.ietf.org/html/rfc5005)) for breaking the list into pages if appropriate. The server MAY also return an OperationOutcome resource with additional information about the search; if one is sent it SHALL NOT include any errors, and it shall be marked with an [entry mode](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-search-entry-mode.html) of include.

#### Variant Searches

To search a [compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartments), either all possible resources, or for a particular resource type, respectively:

GET [base]/[Compartment]/[id]/{\*?[parameters]{&\_format=[mime-type]}}

GET [base]/[Compartment]/[id]/[type]{?[parameters]{&\_format=[mime-type]}}

For example, to retrieve all the observation resources for a particular LOINC code associated with a particular encounter:

GET [base]/Encounter/23423445/Observation?code=2951-2 {&\_format=[mime-type]}

Note that there are a specific operations defined to support fetching [an entire patient record](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient-operations.html#everything) or [all record for an encounter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-operations.html#everything).

Finally, it's possible to search all resources at once:

GET [base]?[parameters]{&\_format=[mime-type]}

When searching all resources at once, only the [parameters defined for all resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#search) can be used.

### conformance

The conformance interaction retrieves the server's conformance statement that defines how it supports resources. The interaction is performed by an HTTP OPTIONS or a GET command as shown:

GET [base]/metadata {?\_format=[mime-type]}

OPTIONS [base] {?\_format=[mime-type]}

Applications SHALL return a [Conformance Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) that specifies which resource types and interactions are supported for the GET command, and SHOULD do so for the OPTIONS command. If a 404 Unknown is returned from the GET, FHIR is not supported on the nominated service url. The GET command is defined because not all client libraries are able to perform an OPTIONS command. An ETag header SHOULD be returned with the conformance resource. The value of the header SHALL change if the conformance statement itself changes. Additional parameters that are required to be returned with the OPTIONS command are defined in the [OMG hData RESTful Transport](#hdata) specification.

The Conformance statement returned typically has an arbitrary id, and no meta element, though it is not prohibited.

In addition to this conformance interaction, a server may also choose to provide the standard set of interactions (read, search, create, update) defined on this page for the [Conformance Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) end point. This is different to the conformance interaction:

|  |  |
| --- | --- |
| conformance interaction | returns a conformance statement describing the server's current operational functionality |
| Conformance end point | manages a repository of conformance statements (e.g. the HL7 conformance statement registry) |

All servers are required to support the conformance interaction, but servers may choose whether they wish to support the conformance end-point, just like any other end point.

### batch/transaction

The batch and transaction interactions submit a set of actions to perform on a server in a single HTTP request/response. The actions may be performed independently as a 'batch', or as a single atomic 'transaction' where the entire set of changes succeed or fail as a single entity. Multiple actions on multiple resources of the same or different types may be submitted, and they may be a mix of other interactions defined on this page (e.g. read, search, create, update, delete, etc), or using the [operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) framework.

The 'transaction' mode is especially useful where one would otherwise need multiple interactions, possibly with a risk of loss of referential integrity if a later interaction fails (e.g. when storing a Provenance resource and its corresponding target resource, or, on document repositories, a document index entry and its accompanying document).

Note that transactions and conditional create/update/delete are complex interactions and it is not expected that every server will implement them.

A batch or transaction interaction is performed by an HTTP POST command as shown:

POST [base] {?\_format=[mime-type]}

The content of the post submission is a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) with [Bundle.type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) = [batch](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-bundle-type.html#batch) or [transaction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-bundle-type.html#transaction). Each entry carries request details ([Bundle.entry.request](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.entry.request)) that provides the HTTP details of the action in order to inform the system processing the batch or transaction what to do for the entry. If the HTTP command is a PUT or POST, then the entry SHALL contain a resource for the body of the action. The resources in the bundle are each processed separately as if they were an individual interactions or operations as otherwise described on this page, or the [Operations framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html). The actions are subject to the the normal processing for each, including the [meta element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta), verification and version aware updates, and [transactional integrity](#transactional-integrity).

Examples:

* [Transaction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-transaction.html)
* [Matching Response](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-response.html)

#### Batch Processing Rules

For a batch, there SHALL be no interpendencies between the different entries in the Bundle. The success or failure of one entry SHALL not alter the sucess or failure or resulting content of another. Servers SHALL validate that this is the case. Note that it is considered that servers execute the batch in the same order as that specified below for transactions, though the order of exceution should not matter given the previous rule.

#### Transction Processing Rules

For a transction, Servers SHALL either accept all actions and return a 200 OK, along with a response bundle (see below), or reject all resources and return an HTTP 400 or 500 type response. It is not an error if the submitted bundle has no resources in it. The outcome of the processing the transaction SHALL NOT depend on the order of the resources in the transaction. A resource can only appear in a transaction once (by identity).

Because of the rules that a transaction is atomic, that all actions pass or fail together, and that order of the entries doesn't matter, there is a particular order in which to process the actions:

1. Process any DELETE interactions
2. Process any POST interactions
3. Process any PUT interactions
4. Process any GET interactions

If any resource identities (including resolved identities from conditional update/delete) overlap in steps 1-3, then the transaction SHALL fail.

**DSTU Note:** clients are able to request that operations be executed as part of a transaction. Some transactions can cause side effects, such as the creation of new resources or other actions that may be difficult to fit into a transaction framework. Input regarding this issue is sought during the DSTU period.

Feedback [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

A transaction may include references from one resource to another in the bundle, including circular references where resources refer to each other. If the server assigns a new id to any resource in the bundle as part of the processing rules above, it SHALL also update any references to that resource in the same bundle as they are processed. References to resources that are not part of the bundle are left untouched. Version-specific references should remain as version-specific references after the references have been updated. Servers SHALL replace all matching links in the bundle, whether they are found in the resource ids, resource references, url elements, or <a href="" & <img src="" in the narrative.

When processing a batch or transaction, a server MAY choose to honour existing logical ids (e.g. Observation/1234 remains as Observation/1234 on the server), but since this is only [safe in controlled circumstances](#upsert), servers may choose to assign new ids to all submitted resources, irrespective of any claimed logical id in the resource, or fullUrl on entries in the batch/transaction.

#### Batch/Transaction Response

In order to allow the client to know the outcomes of processing the entry, and the identities assigned to the resources by the server, the server SHALL return a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle) with [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) set to batch-response or transaction-response that contains one entry for each entry in the request, in the same order, with the outcome of processing the entry.

Each entry element SHALL contain a response element which details the outcome of processing the entry - the HTTP status code, and the location and ETag header values, which are used for identifying and versioning the resources. In addition, a resource may be included in the entry, as specified by the [Prefer](#prefer) header.

#### Accepting Other bundle types

A server may choose to accept bundle types other than batch or transaction when POSTed to the [base] URL.

Bundles of type history inherently have the same structure as a transaction, and can be treated as either a transaction or batch, so servers SHOULD accept a history bundle - this makes it possible to replicate data from one server to another easily using a pub/sub model. Note, however, that the original transaction boundaries may not represented in a history list, and a resource may occur more than once in a history list, so servers processing history bundles must have some strategy to manage this.

For other bundle types, should the server choose to accept them, there will be no request element (note that every entry will have a resource). In this case, the server treats the entry as either a create or an update interaction, depending on whether it recognises the identity of the resource - if the identity of the resource refers to a valid location on the server, it should treat it as an update to that location. Note: this option allows a client to delegate the matching process to the server.

### history

The history interaction retrieves the history of either a particular resource, all resources of a given type, or all resources supported by the system. These three variations of the history interaction are performed by HTTP GET command as shown:

GET [base]/[type]/[id]/\_history{?[parameters]&\_format=[mime-type]}

GET [base]/[type]/\_history{?[parameters]&\_format=[mime-type]}

GET [base]/\_history{?[parameters]&\_format=[mime-type]}

The return content is a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle) with [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) set to history containing the specified version history, sorted with oldest versions last, and including deleted resources. Each entry SHALL minimally contain a either a resource which holds the resource as it is at the conclusion of the interaction, or a request with entry.request.method = DELETE. The request provides information about the interaction that occurred to cause the new version, and allows, for instance, subscriber system to differentiate between create and update interactions. The principal reason a resource might be missing is that the resource was changed by some other channel than via the RESTful interface. If the entry.request.method is a PUT or a POST, the entry SHALL contain a resource.

The interactions [create](#create), [update](#update), and [delete](#delete) create history entries. Other interactions do not (note that these operations may produce side-effects such as new AuditEvent resources; these are represented as create interactions in their own right). New resources or updates to existing resources that are triggered by operations also appear in the history, as to updates to the resources that result from interactions outside the scope of the RESTful interface.

A create interaction is represented in a history interaction in the following way:

<entry>

<resource>

<Patient>

<!-- the id of the created resource -->

<id value="23424"/>

<!-- snip -->

</Patient>

</resource>

<request>

<!-- POST: this was a create -->

<method value="POST"/>

<url value="Patient"/>

</request>

</entry>

Note that conditional creates, updates and deletes are converted to direct updates and deletes in a history list.

In addition to the standard \_format parameter, the parameters to this interaction may also include:

|  |  |  |
| --- | --- | --- |
| \_count : [integer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer) | single | Number of return records requested. The server is not bound to return the number requested, but cannot return more |
| \_since : [instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer) | single | Only include resource versions that were created at or after the given instant in time |

The history list can be restricted to a limited period by specifying a \_since parameter which contains a full date time with time zone. Clients should be aware that due to timing imprecision, they may receive notifications of a resource update on the boundary instant more than once. Servers are not required to support a precision finer than by second.

The updates list can be long, so servers may use paging. If they do, they SHALL use the method [described below](#paging) for breaking the list into pages if appropriate, and maintain the specified \_count across pages.

The history interaction can be used to set up a subscription from one system to another, so that resources are synchronized between them. Refer to the [Subscription resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html) for an alternate means of system synchronization.

### Transactional Integrity

When processing [create](#create) and [update](#update) interactions, a FHIR server is not obliged to accept the entire resource as it is; when the resource is retrieved through a [read](#read) interaction subsequently, the resource may be different. The difference may arise for several reasons:

* The server merged updated content with existing content
* The server applied business rules and altered the content
* The server does not fully support all the features or possible values of the resource

Note that there is no general purpose method to make merging with existing content or altering the content by business rules safe or predictable - what is possible, safe and/or required is highly context dependent. These kind of behaviors may be driven by security considerations. With regard to incomplete support, Clients can consult the server's base conformance statement profile references to determine which features or values the server does not support.

To the degree that the server alters the resource for any of the 3 reasons above, the FHIR server will create implementation consequences for the eco-system that it is part of, which will need to be managed (i.e. it will cost more). For this reason, servers SHOULD change the resource as little as possible, given the constraints of the system exposing the FHIR resource. However due to the variability that exists within healthcare, this specification allows that servers MAY alter the resource on create/update.

Similarly, to the degree that an implementation context makes special rules about merging content or altering the content, that context will become more expensive to maintain.

Although these rules are stated with regard to servers, a similar concept applies to clients - to the degree that different client systems interacting with the server do not support the same feature set, the clients and/or the server will be forced to implement custom logic to prevent information from being lost or corrupted.

Some of these problems can be mitigated by following a pattern built on top of version-aware updates. In this pattern:

* The server provides a [read](#read) interaction for any resource it accepts [update](#update) interactions on
* Before updating, the client [reads](#read) the latest version of the resource
* The client applies the changes it wants to the resource, leaving other information intact (note the [extension related rules](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#exchange) around this)
* The client writes the result back as an [update](#update) interaction, and is able to handle a 409 or 412 response (usually by trying again)

If clients follow this pattern, then information from other systems that they do not understand will be maintained through the update.

Note that it's possible for a server to choose to maintain the information that would be lost, but there is no defined way for a server to determine whether the client omitted the information because it wasn't supported (perhaps in this case) or whether it wishes to delete the information.

#### Conformance

Both client and server systems SHOULD clearly document how transaction integrity is handled.

**DSTU Note:** For now, the only way to document how transaction integrity is handled is as text in the narrative portions of the [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) resource. Feedback during the Trial use period on what - if any - of this information should be computable is welcome.

Feedback [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

### Paging

If servers provide paging for the results of a [search](#search) or [history](#history) interaction, they SHALL conform to this method (adapted from [RFC 5005 (Feed Paging and Archiving)](https://tools.ietf.org/html/rfc5005) for sending continuation links to the client when returning a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) (e.g. with history and search). If the server does not do this, there is no way to continue paging.

This example shows the third page of a search result:

<Bundle xmlns="http://hl7.org/fhir">

<!-- snip metadata -->

<!-- This Search. url starts with base search, and adds the effective

parameters, and additional parameters for search state. All searches

SHALL return this value.

In this case, the search continuation method is that the server

maintains a state, with page references into the stateful list.

-->

<link>

<relation value="self">

<url value="http://example.org/Patient?name=peter&stateid=23&page=3"/>

</link>

<!-- 4 links for navigation in the search. All of these are optional, but recommended -->

<link>

<relation value="first"/>

<url value="http://example.org/Patient?name=peter&stateid=23&page=1"/>

</link>

<link>

<relation value="previous"/>

<url value="http://example.org/Patient?name=peter&stateid=23&page=2"/>

</link>

<link>

<relation value="next"/>

<url value="http://example.org/Patient?name=peter&stateid=23&page=4"/>

</link>

<link>

<relation value="last"/>

<url value="http://example.org/Patient?name=peter&stateid=23&page=26"/>

</link>

<!-- then the search results... -->

</Bundle>

The server need not use a stateful paging method as shown in this example - it is at the discretion of the server how to best ensure that the continuation retains integrity in the context of ongoing changes to the resources. An alternative approach is to use version specific references to the records on the boundaries, but this is subject to continuity failures when records are updated.

A server MAY inform the client of the total number of resources returned by the interaction for which the results are paged using the [Bundle.total](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.total).

Note that for search, where \_include can be used to return additional related resources, the total number of resources in the feed may exceed the number indicated in totalResults.

### Intermediaries

The HTTP protocol may be routed through an HTTP proxy such as squid. Such proxies are transparent to the applications, though implementers should be alert to the effects of caching, particularly including the risk of receiving stale content. See the [HTTP specification](http://tools.ietf.org/html/rfc2616#page-74) for further detail

Interface engines may also be placed between the consumer and the provider. These differ from proxies because they actively alter the content and/or destination of the HTTP exchange and are not bound the rules that apply to HTTP proxies. Such agents are allowed, but SHALL mark the http header to assist with troubleshooting.

Any agent that modifies an HTTP request or Response content other than under the rules for HTTP proxies SHALL add a stamp to the HTTP headers like this:

request-modified-[identity]: [purpose]

response-modified-[identity]: [purpose]

The identity SHALL be a single token defined by the administrator of the agent that will sufficiently identify the agent in the context of use. The header SHALL specify the agent's purpose in modifying the content. End point systems SHALL not use this header for any purpose. Its aim is to assist with system troubleshooting.

### OMG hData RESTful Transport

This RESTful specification described here is based on the [OMG Health RESTful specification (HData)](http://www.omg.org/spec/HData/). In this regard, FHIR functions as a Record Format Profile as described in that specification. Note the following significant factors to be aware of:

* FHIR maps the hData sections to resource types, and hData documents to resource instances. There are no subsections, and client systems are not able to create new sections, though [compartments](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartments) behave somewhat like sections
* Because clients cannot submit new sections (POST to service URL), POST to the service URL has been re-used for [the transaction interaction](#transaction) (difference under review)
* 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 conformance statement, which describes what it is capable of doing)
* Note that this specification does not repeat the rules in the hData RESTful Transport concerning the OPTIONS command on the service URL, but these rules (extra headers etc.) still apply

### Summary

These tables present a summary of the interactions described here. Note that *all* requests may include an optional Accept header to indicate the format used for the response (this is even true for DELETE since an OperationOutcome may be returned).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Interaction** | **Path** | **Request** | | | | |
|  | | **Verb** | **Content-Type** | **Body** | **Prefer** | **Conditional** |
| read | /[type]/[id] | GET | N/A | N/A | N/A | O: ETag, If-Modified-Since, If-None-Match |
| vread | /[type]/[id]/\_history/[vid] | GET | N/A | N/A | N/A | N/A |
| update | /[type]/[id] | PUT | R | Resource | O | O: If-Match |
| delete | /[type]/[id] | DELETE | N/A | N/A | N/A | N/A |
| create | /[type] | POST | R | Resource | O | O: If-None-Exist |
| search | /[type]? | GET | N/A | N/A | N/A | N/A |
| /[type]/\_search? | POST | application/x-www-form-urlencoded | form data | N/A | N/A |
| search-all | /\_search? | GET | N/A | N/A | N/A | N/A |
| conformance | / or /metadata | OPTIONS or GET | N/A | N/A | N/A | N/A |
| transaction | / | POST | R | Bundle | O | N/A |  |
| history | /[type]/[id]/\_history | GET | N/A | N/A | N/A | N/A |  |
| history-type | /[type]/\_history | GET | N/A | N/A | N/A | N/A |  |
| history-all | /\_history | GET | N/A | N/A | N/A | N/A |  |
| (operation) | /$[name], /[type]/$[name] or /[type]/[id]/$[name] | POST | R | Parameters | N/A | N/A |  |
| GET | N/A | N/A | N/A | N/A |  |
| POST | application/x-www-form-urlencoded | form data | N/A | N/A |  |

Notes:

* N/A = not present, R = Required, O = optional
* For operations defined on all resources, including direct access to the meta element, see [Resource Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource-operations.html)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Interaction** | **Response** | | | | | |
|  | **Content-Type** | **Body** | **Location** | **Versioning** | **Status Codes** |  |
| read | R | R: Resource | N/A | R: ETag, Last-Modified | 200, 404, 410 |  |
| vread | R | R: Resource | N/A | R: ETag, Last-Modified | 200, 404 |  |
| update | R if body | O: Resource (Prefer) | R on create | R: ETag, Last-Modified | 200, 201, 400, 404, 405, 409, 412, 422 |  |
| delete | R if body | O: OperationOutcome | N/A | N/A | 200, 204, 404, 405, 409, 412 |  |
| create | R if body | O : Resource (Prefer) | R | R: ETag, Last-Modified | 201, 400, 404, 405, 422 |  |
| search | R | R: Bundle | N/A | N/A | 200, 403? |  |
| search-all | R | R: Bundle | N/A | N/A | 200, 403? |  |
| conformance | R | R: Conformance | N/A | N/A | 200, 404 |  |
| transaction | R | R: Bundle | N/A | N/A | 200, 400, 404, 405, 409, 412, 422 |  |
| history | R | R: Bundle | N/A | N/A | 200 |  |
| history-type | R | R: Bundle | N/A | N/A | 200 |  |
| history-all | R | R: Bundle | N/A | N/A | 200 |  |
| (operation) | R | R: Parameters/Resource | N/A | N/A | 200 |  |

Note: this table lists the status codes described here, but other status codes are possible as described by the HTTP specification. Additional codes that are likely a server errors and various codes associated with authentication protocols.

# identifier-registry.html

## Known Identifier Systems

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The following names (URIs) may be used in the *system* element of the [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) data type. If a URI is defined here, it SHALL be used in preference to any other identifying mechanisms. If an identifier system is not listed here, the correct URI may be determined by working through the following list, in order:

* the HL7 OID Registry
* the documentation associated with the identifier
* consulting the owner of the identifier
* asking on the HL7 vocabulary mailing list

See also the [list of known coding systems](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html) that can be used in the *system* element of the [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) data type. Additional identifier systems may be registered on the HL7 FHIR registry at <http://fhir.org/registry>.

**Important Note:** This list of URIs is incomplete and subject to change. Some values may be dropped and others will likely be added in the coming months as HL7 institutes formal processes around URIs in vocabulary.

The URI column indicates the correct value to use in the [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier).system. The OID is provided for compatibility with V2/CDA based systems.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **identifier** | **URI** | **OID** | **Type** | **Comment** |
| URIs ([W3C](http://www.w3.org)): when the identifier is a URI | urn:ietf:rfc:3986 |  |  | As defined by [RFC 3986](http://www.ietf.org/rfc/rfc3986.txt) (with many schemes defined in many RFCs). For OIDs and UUIDs, use the URN form ([urn:oid:](http://www.ietf.org/rfc/rfc3001.txt) (note: lowercase) and [urn:uuid:](http://www.ietf.org/rfc/rfc4122.txt) |

# ig-profiles.html

## Profiles Defined by this Implementation Guide

This table contains a list of all the profiles defined as part of the Implementation Guide.

# ig-terminologies-valuesets.html

## Value Sets Defined in

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\resource.html#maturity): | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\help.html#status): |

This table contains a list of all the value sets defined as part of the . See also the list of value sets [defined by the FHIR specification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\terminologies-valuesets.html).

# ig-valuesets.html

## Value Sets Defined by this Implementation Guide

This table contains a list of all the value sets defined as part of the Implementation Guide. Some of these value sets include codes defined elsewhere, some define their own codes, and some do both.

# iglist.html

## Implementation Guides defined as part of FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

An Implementation Guide is a collection of [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html), that make [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html) rules (technially, [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html), [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html), [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html), etc) that, together with textual guidance, that provides instruction on how to make use of FHIR in a particular problem space. Implementation guides may be developed and published as part of a FHIR release or as separate specifications. Additional support and tooling for implementation guides is being developed, so the content provided here should be considered "preliminary" from a publication perspective.

The implementation guides include a set of representations generated from the conformance resources. All the forms are equally normative. Many examples are also provided, and considerable care is taken over them. However, unless indicated otherwise, the examples have no formal standing (see [General Notes about examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#examples)).

Note: At present, some implementation guides are published in conjunction with the FHIR specification because tooling that supports straightforward independent publication is not yet developed. However, the intention is that in the future implementation guides will be published separately from the core FHIR specification. The various implementation guides are subject to separate ballots than the FHIR specification. There is a registry of [additional implementation guides](http://wiki.hl7.org/index.php?title=FHIR_Profiles_from_other_Organizations).

The predominance of US implementation guides in this specification is a reflection of the current point in the lifecycle of standards development for the US program. It should in no way be interpreted as suggesting that FHIR is a US-centric specification.

|  |  |  |
| --- | --- | --- |
| **Name** | **Usage** | **Ballot** |
| [Argonaut Project](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\argonaut\argonaut.html) | A joint task force of the HIT Standards and Policy Committees: a first-generation FHIR-based API and Core Data Services specification | There is no balloted content associated with the Argonaut project. Comments against the Argonaut implementation guide can be made to [Project Argonaut Google Group](https://groups.google.com/forum/#!forum/argonaut-project) |
| [Data Access Framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html) | A U.S. Realm guide for making use of FHIR resources to support queries between systems within an enterprise and across enterprises | DAF has its own ballot |
| [EHRS Functional model - Record Lifecycle Events](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ehrsrle\ehrsrle.html) | Describes the use of the [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) and [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resources to support meeting the needs of the EHRS functional model requirements for tracking record lifecycle. | FHIR DSTU ballot |
| [Quality Improvement Core Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\qicore\qicore.html) | An implementation guide for making use of FHIR resources in clinical quality measures and clinical decision support applications. Developed for the U.S. Realm, but more broadly applicable. | QICore has its own ballot |
| [Clinical Quality Improvement Framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\cqif\cqif.html) | A Universal Realm guide for implementing quality improvement functionality in a native FHIR environment. | CQIF has its own ballot |
| [Structured Data Capture](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\sdc\sdc.html) | A U.S. Realm guide for making use of [Data Elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html), [Questionnaires](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) and [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html) to support pre-population and auto-population of forms. | SDC has its own ballot |
| [Structured Data Capture - Data Element Exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\sdcde\sdcde.html) | A U.S. Realm guide for supporting the exchange and maintenance of [Data Elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) by and between data element registries. | SDC has its own ballot |
| [US Laboratory Guides (USLab)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\uslab\uslab.html) | A US Realm laboratory guides making use of [Diagnostic Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html), [Diagnostic Report](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html), and FHIR resources referenced by them to support ordering reporting of laboratory tests in ambulatory care and for reporting of reportable lab tests to Public Health jurisdictions. | FHIR DSTU ballot |

# implementation.html

# Implementation

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

|  |  |  |
| --- | --- | --- |
| **Exchange Frameworks**  Define how Resources are exchanged.   * [**RESTful API (HTTP)**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) * [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) * [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) * [Documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) * [Messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html) * [Services:](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html)   + [Terminology Service](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminology-service.html)   + [SOA Considerations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\soa.html) | **Support**  Implementation Support.   * [Downloads - Schemas, Code, Tools](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html) * [FHIR Wiki](http://wiki.hl7.org/index.php?title=FHIR) * [Validating Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\validation.html) * [Security](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html) & [Security Labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) * [Variations between Submitted data and Retrieved data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\updates.html) * [Managing Resource Identity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html) * [Push vs Pull](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\pushpull.html) * [Integrated Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\integrated-examples.html) * [Support Links (on FHIR Wiki)](http://wiki.hl7.org/index.php?title=FHIR_Support_Page) | **FHIR Profiles & Implementation Guides**  Adapting FHIR for specific usage.   * [Profiling FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) * [Implementation Guides](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\iglist.html) * [Profiles Defined as part of FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profilelist.html) * [Common Use Cases](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\usecases.html) |

### Implementer's Safety Check List

FHIR is as simple to implement as we know how to make it. However, due to the nature of healthcare, and healthcare processes, and cultural concerns, there are a number of features in FHIR that implementers are obliged to consider in order to implement safe systems.

This section is a check list to help implementers be sure that they've considered all the parts of FHIR that impact on their system design with regard to safety.

1. Production exchange of patient or other sensitive data will always use some form of [encryption on the wire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#http)
2. For each resource that my system handles, I've reviewed the [Modifier elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#isModifier)
3. My system checks for [modifierExtension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#modifierExtension) elements
4. My system supports [elements labelled as "must-support"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#mustSupport) in the [profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) that apply to my system
5. For each resource that my system handles, my system handles the full [Life cycle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html) (status codes, currency issues, and erroneous entry status)
6. My system can [render narratives properly](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html#css) (where they are used)
7. My system has documented how [distributed resource identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html#distributed) works in its relevant contexts of use, and where (and why) [contained](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#contained) resources are used
8. My system manages lists of [current resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current) correctly
9. My system makes the right [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) statements and [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) logs, and uses the right [security labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html#core) where appropriate
10. My system checks that the right [Patient consent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\consentdirective.html) has been granted (where applicable)
11. When other systems [return http errors from the RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#summary) and [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) (perhaps using [Operation Outcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html)), my system checks for them and handles them appropriately
12. My system publishes a [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) with [StructureDefinitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html), [ValueSets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html), and [OperationDefinitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html), etc, so other implementers know how the system functions

Obviously this list is only a small part of the overall safety check list for an application, which will have checks regarding jurisdictionally mandated policies, internal integrity, etc.

# index.html

# Welcome to FHIR®

First time here? See the [executive summary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\summary.html), the [developer's introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-dev.html), or the [clinical introduction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview-clinical.html), and then the [FHIR overview / roadmap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\overview.html). See also the [open license](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\license.html) (and don't miss the full [Table of Contents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\toc.html)).

**Major Sections:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [General Documentation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentation.html) | [Implementation & Exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementation.html) | [Clinical Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinical.html) | [Administrative Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html) | [Infrastructural Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\infrastructure.html) |

**Quick links:**

|  |  |  |
| --- | --- | --- |
| Documentation   * [Resource List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) * [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html), [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) & [RDF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rdf.html) * [REST API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) & [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) * [Data Types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) * [Using Terminologies](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) * [Extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) * [Full table of contents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\toc.html) | Implementation   * [Downloads](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html) * [Adapting FHIR for local use](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) * [Implementation Guides](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\iglist.html) * [FHIR Schemas & Schematrons](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-all-xsd.zip) * Examples: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\examples.zip), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\examples-json.zip) * Code: Java, C#, Pascal, iOS, JS, XML * [Common Use Cases](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\usecases.html) & [Profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profilelist.html) * [Security](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html) | External Links   * [Support Links](http://wiki.hl7.org/index.php?title=FHIR_Support_Page) (StackOverflow, Forum, etc) * [Public Test Servers & Software](http://wiki.hl7.org/index.php?title=Publicly_Available_FHIR_Servers_for_testing) * [How FHIR is developed](http://wiki.hl7.org/index.php?title=FHIR_Methodology_Process) * [FHIR Wiki](http://wiki.hl7.org/index.php?title=FHIR) * [Implementation guide registry](http://wiki.hl7.org/index.php?title=FHIR_Profiles_from_other_Organizations) * [Blogs that cover FHIR](http://wiki.hl7.org/index.php?title=FHIR_Blogs) * Translations: [Russian](http://fhir-ru.github.io/index.html), [Japanese](https://sites.google.com/site/fhirjp/) |

Note: This specification requires a browser that is SVG compatible (Microsoft Internet Explorer 10+, Firefox 3.0+, Chrome, or Safari), and uses the browser's session storage to remember which tabs are active.

# infrastructure.html

## Infrastructure Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

|  |  |  |
| --- | --- | --- |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#binary) |  | Pure Binary Content - opaque to FHIR |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |
| **Name** | **Aliases** | **Description** |

Additional Resources will be added in the future. A list of hypothesized resources can be found on the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR_Resource_Types). Feel free to add any you think are missing or engage with one of the [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm) to submit a [proposal](http://wiki.hl7.org/index.php?title=Category:FHIR_Resource_Proposal) to define a resource of particular interest.

# integrated-examples.html

## Integrated Examples

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

These integrated examples are the result of choosing several real world ob healthcare records from a Dutch healthcare institution and representing them using FHIR resources. They are made published here for several reasons:

* To test that the resources are fit for purpose using real cases
* So that the available resource examples include real cases
* So that applications have real world clinical cases to use in development and prototyping

### Patient case 1

The 69 year old Pieter van den Heuvel is charged with some serious diseases over the last few years. In the spring and summer of 2011, Pieter had complains of fatigue, dyspnea and even fainting. After visiting his physician, Pieter was referred to the cardiologist for further examination. At the hospital a malfunction of the heart valve was diagnosed and eventually replaced. Pieter recovered well in the next 2 months, but probably needs a life time prescription on blood pressure reducing medication. In the summer of 2012, Pieter again visited his physician for a chest injury after he fell from the stairs. By coincidence, the doctor noticed a suspicious stain on the X-thorax and performed some additional tests on Pieter. After the results, Pieter was diagnosed with early stage non-small cell lung cancer. Fortunately, the tumor didn't spread to other parts of the body. Tumor type and location made it possible to perform a partial lobectomy in the right lung. After his recovery, Pieter was submitted to a high risk control group for yearly screening.

In 2013, Pieter was charged with an increasing neck swelling, a stiff neck and difficulty swallowing. Because of breathing problems, Pieter was urgently admitted to the hospital. An upper respiratory infection caused a retropharyngeal abscess in the back of the throat. Surgery was needed to remove the abscess. The surgeons recommended a tracheotomy during the surgery, so there was less change of complications during the abscess removal. A tracheotomy was intubated before the surgery. After the removal of the retropharyngeal abscess, the tracheotomy was extubated as the swelling was reduced and normal breathing became reinstated.

#### Patient demographic information

Patient name: [Pieter van den Heuvel](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient-example-f001-pieter.html)

Patient number: 0108173

Date of birth: 17-11-1944

Gender: Male

#### Patient contact information

Address: van Egmondkade 23

Zip code: 1024 RJ

City: Amsterdam

Phone: +31648352638

email: p.heuvel@gmail.com

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Intakes | | | | | | | | | |
| **intake date** | **surgery date** | **practitioner** | **specialism** | **diagnose** | **procedure** | **care plan** | **surgery code** | **SNOMED CT code** | **related encounter** |
| 26-6-2011 | 27-6-2011 | [P. Voigt](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f002-pv.html) | [CTC (Cardio-thoracale Chirurgie)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f002-burgers-card.html) | [Heart valve disorder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f001-heart.html) | [Heart valve replacement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f001-heart.html) | [CP2903](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f001-heart.html) | 1000263502 | 64915003 | [v1451](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f001-heart.html) |
| 6-7-2012 | 7-7-2012 | [M.I.M. Versteegh](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f003-mv.html) | [CTC (Cardio-thoracale Chirurgie)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f002-burgers-card.html) | [NSCLC - Non-small cell lung cancer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f002-lung.html) | [partial lobectomy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f002-lung.html) | [CP2934](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f002-lung.html) | 1000263813 | 173171007 | [v3251](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f002-lung.html) |
| 22-3-2013 | 22-3-2013 | [A.P.M. Langeveld](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f005-al.html) | [ENT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f003-burgers-ENT.html) | [Retropharyngeal abscess](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f003-abscess.html) | [Trachea-tracheotomy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f003-abscess.html) | CP2938 | 1000050465 | 48387007 | [v6751](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f003-abscess.html) |
| 24-3-2013 | 24-3-2013 | [E.M.J.M. van den broek](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f001-evdb.html) | [ENT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f003-burgers-ENT.html) | [Retropharyngeal abscess](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f003-abscess.html) | [retropharyngeal abscess](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f003-abscess.html) | [CP3953](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f003-pharynx.html) | 1000049161 | 172960003 | [v6751](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f003-abscess.html) |
| 27-3-2013 | 27-3-2013 | [R.J.P. Briet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f004-rb.html) | [ENT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f003-burgers-ENT.html) | [Retropharyngeal abscess](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f003-abscess.html) | Trachea-extubatie | CP1283 | 1000050159 | 309812005 | [v6751](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f003-abscess.html) |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Active medication | | | | | | | |
| **medication** | **hopital/home** | **dose** | **admission route** | **start date** | **presciber** | **SNOMED CT code** | **prescription nu** |
| [Salbutamol+ipratropium bromide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f001-combivent.html) | hopital | 3/4 times daily 1 flacon | inhaler | 8-4-2013 | R.A. van den Berk | 320442002 | [2983](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f001-combivent.html) |
| [rosuvastatine](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f002-crestor.html) | hopital | 1 time daily 10 mg | oral | 7-7-2011 | R.A. van den Berk | 408036003 | [1029](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f002-crestor.html) |
| [Tolbutamide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f003-tolbutamide.html) | home | 3 times daily 500 mg | oral | 7-7-2011 | S.M. Heps | 325267004 | [8473](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f003-tolbutamide.html) |
| [metoprolol](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f004-metoprolol.html) | home | 1 time daily 50 mg | oral | 1-5-2011 | S.M. Heps | 318475005 | [9517](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f004-metoprolol.html) |
| [enalapril](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f005-enalapril.html) | home | 1 time daily 5 mg | oral | 1-5-2011 | S.M. Heps | 318851002 | [7119](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f005-enalapril.html) |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Device | | | | | | |
| **device** | **hopital/home** | **dose** | **admission route** | **start date** | **presciber** | **SNOMED CT code** |
| [Feeding tube](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\device-example-f001-feedingtube.html) | hopital | N.A. | tube | 10-4-2013 | R.A. van den Berk | 61420007 |

|  |
| --- |
| Lab results |
| [diagnostic blood report](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport-example-f001-bloodexam.html) |
| **date** | **substance** | **value** | **status** |
| 2013-04-02 | [glucose](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f001-glucose.html) | 6,3 mmol/l | abnormal |
| 2013-04-02 | [base excess](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f001-glucose.html) | 12,6 mmol/l | abnormal |
| 2013-04-02 | [carbon dioxide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f001-glucose.html) | 6,2 mm[Hg] | abnormal |
| 2013-04-02 | [erytrocyten](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f001-glucose.html) | 18,7 g/dl | abnormal |
| 2013-04-02 | [Hemoglobin](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f001-glucose.html) | 7,5 g/dl | abnormal |

#### Anamnese

***date: 8-6-2012*** Bronchoscopy; several biopsy specimen were taken from pathological mucosa, right main bronchus specimen send for pathologic analysis. Bronchoscopy because of atelectasis right. X-thorax; increase in atelectasis and pleural liquid. Bronchoscopy;   
-fluids drained from right main bronchus   
-pathalogic mucous membrane right bronchus, easily bleeding   
-left bronchial system open ***date: 18-3-2013*** Antiobiotic policy with retropharyngeal abscess with prolapse to the mediatinum. No surgical possibility to fully drain the mediatinum.

#### Physical investigation

***date: 18-3-2013*** Neck; swelling and redness pretracheal extending to chest. No fluctation, however induration is present. Swelling back pharynx, also present in postcricoid area. Light stridor sound when breathing. Overall condition is good. Scoop; little supraglottic swelling, vocal chords not judgable.

#### Additional research

CT thorax: no mediastinal/retropharyngal collering of the fluid collections. Diffuse edema retro/parapharyngeal and mediastinitis. Preoperative culture shows; S pyogenes, sensitivity for peneciline and E. cloacae, sensitivity for Salbutamol.

#### Policy

Stop Salbutamol prescription. Continue penicilin and start salbutamol supplementation. Total treatment time is approximatly 6 weeks. In consultation with the IC/anesthesia; intubation. Analyse lower respiratory tract.

#### Conclusion

Extubation on OR. Normal voice, no stridor. However, hypoxic at low respiratory tract obstruction with 84% O2 and rapid breathing.

### Patient case 2

Patient name: [Roel Bor](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient-example-f201-roel.html)

Patient number: 123456789

Date of birth: 1960-03-13

Gender: Male

#### Patient contact information

Address: Bos en Lommerplein 280

Zip code: 1055 RW

City: Amsterdam

Phone: +31612345678

Roel Bor is in his mid-fifties, works for an IT-company and has two healthy children and a wife. His uncle unfortunately was less healthy and died of cancer. At the end of 2012, Roel was also diagnosed with a tumor in the Erasmus Medical Center. His tumor is located in the head-neck area. The standard treatment for that is TPF-chemotherapy. The tumor is not fully curable due to its position, but it was optimally minimized with the therapy in the AUMC. Two severe complications followed the treatment, namely bacterial sepsis (streptococcus aureus) and renal failure. Both were stabilized within a short period through medication (see care plan). Roel thereafter had his ups and downs with the last known condition of a severe fever, for which he received among other treatment (paracetamol). On a side-note and as a final statement: the patient suffers from house dust allergy.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Intakes | | | | | | | | | | |
| **practitioner** | **organization** | **careplan** | **start date** | **substance** | **condition** | **other participant** | **procedure** | **encounter ID** | **surgery code** | **SNOMED CT code** |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | [Artis University Medical Center](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f201-aumc.html) | [CP3928](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f201-renal.html) | 2013-03-11 | [potassium](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\substance-example-f203-potassium.html) | [fever](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f201-fever.html) | [Carla Espinosa](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f204-ce.html) |  | [20130404](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f201-20130404.html) | 100028475 | 64915003 |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | [Artis University Medical Center](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f201-aumc.html) | [CP7364](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f202-malignancy.html) |  |  | [malignant tumor](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f202-malignancy.html) |  | [chemotherapy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f201-tpf.html) | [20130128](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f202-20130128.html) | 100028475 | 363346000 |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | [Artis University Medical Center](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f201-aumc.html) | [CP8766](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan-example-f203-sepsis.html) | 2013-03-11 |  | [Bacterial sepsis](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f203-sepsis.html) | [Luigi Maas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f202-lm.html) | observation | [20130311](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f203-20130311.html) | 100028475 | 363346000 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diagnoses | | | | | | | | | |
| **practitioner** | **date** | **encounter** | **reason** | **condition** | **medication** | **medication prescription** | **procedure** | **diagnostic report** | **issued by** |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 28-1-2013 | [20130128](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f202-20130128.html) | chemotherapy | [malignant tumor](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f202-malignancy.html) |  |  | [chemotherapy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure-example-f201-tpf.html) | [CT scan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport-example-f201-brainct.html) | [BUMC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f203-bumc.html) |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 4-3-2013 | [20130404](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f201-20130404.html) | fever | [fever](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f201-fever.html) | [paracetamol](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f203-paracetamol.html) | [Paracetamol 500mg tablet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f203-paracetamol.html) |  |  |  |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 11-3-2013 | [20130311](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f203-20130311.html) | sepsis | [Bacterial sepsis](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f203-sepsis.html) | [Flutacisone + Salmeterol](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f201-salmeterol.html) | [Salmeterol+fluticasone inhaler](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f201-salmeterol.html) |  | [blood culture](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport-example-f202-bloodculture.html) | [AUMC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f201-aumc.html) |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 11-3-2013 | [20130311](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter-example-f203-20130311.html) | renal | [Renal insufficiency](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition-example-f204-renal.html) | [Flucloxacillin](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication-example-f202-flucloxacilline.html) | [Injected floxacillin](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder-example-f202-flucloxacilline.html) |  | [blood culture](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport-example-f202-bloodculture.html) | [AUMC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization-example-f201-aumc.html) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Observations | | | | | |
| **practitioner** | **date** | **observation** | **value** | **status** | **SNOMED CT code** |
| [Luigi Maas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f202-lm.html) | 11-3-2013 | [Blood culture for bacteria](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f206-staphylococcus.html) | Gram-positive bacteria | positive | 8745002 |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 4-4-2013 | [temperature taken](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f202-temperature.html) | 39 degrees Celsius1 | high | 89003005 |
| [A. Bronsig](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f201-ab.html) | 4-4-2013 | [Serum bicarbonate measurement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f203-bicarbonate.html) | 28mmol/L | normal | 271239003 |
| [Luigi Maas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f202-lm.html) | 4-4-2013 | [Serum creatinine raised](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f204-creatinine.html) | 122 umol/L | high | 166717003 |
| [Luigi Maas](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner-example-f202-lm.html) | 4-4-2013 | [Epidermal Growth Factor Receptor](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-f205-egfr.html) | Negative for EGF receptor expression (Non-small cell lung cancer) | negative | 427038005 |

# json.html

## JSON Representation of Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The JSON representation for a resource is described using this format:

{

"resourceType" : "[**Element**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\element-definitions.html#Element)",

// from [Source](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html): [elemnt #1](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)

"[property1](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : "<[[primitive]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html)>", // short description

"[property2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : { [[Data Type]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) }, // short description

"[property3](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : { // Short Description

"[propertyA](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : { [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept) }, // [Short Description](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html) ([Example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#example))

},

"[property4](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : [{ // Short Description

"[propertyB](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)" : { [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference)([ResourceType](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html)) } // **R!** Short Description

}]

}

Using this format:

* To build a valid JSON instance of a resource, replace the contents of the property values with valid content as described by the type rules and content description found in the property value for each element
* In this example:
  1. property1 has a primitive data type; the value of the property will be as described for the stated type
  2. property2 has a complex data type; the value of the property is an object that has the content as described for the stated type
  3. property3 is an object property that contains additional properties (e.g. propertyA; the allowable properties are listed (but also include extensions as appropriate)
  4. property4 is an array property that contains items which are objects themselves. The items may have any of the types already encountered in points 1-3
  5. propertyA has a binding to a value set - the Short description is a link to the value set. In addition, the binding strength is shown
  6. propertyB is a reference to a particular kind of resource
* Property names are case-sensitive (though duplicates that differ only in case are never defined)
* Properties can appear in any order
* XHTML is represented as an escaped string
* Objects are never empty. If an element is present in the resource, it SHALL have properties as defined for its type, or 1 or more [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)
* String property values can never be empty. Either the property is absent, or it is present with at least one character of content
* The **R!** denotes that an element is mandatory - it must be present (or in an array, at least one item must be present)
* In this format, // is used for comments but these can't be in the JSON instances
* The character encoding is always UTF-8
* The MIME-type for this format is application/json+fhir.

Given the way [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) work, applications reading JSON resources will never enocunter unknown properties. However once an application starts trading with other appplications that conform to later versions of this specification, unknown properties may be encountered. Applications MAY choose to ignore unknown properties in order to foster forwards compatibility in this regard, but may also choose not to. Applications declare their behaviour with regard to unknown elements using [Conformance.acceptUnknown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-definitions.html#Conformance.acceptUnknown).

### Comparison with XML

The JSON format is similar to the XML format:

* The names for the JSON object members are the same as the names of the elements and attributes in XML, including elements that may repeat. Property names are case sensitive
* Just as in XML, JSON objects and arrays are never empty, and properties never have null values (except for a special case documented below). Omit a property if it is empty
* JSON whitespace is not part of the contents of a resource. Applications MAY preserve the whitespace when handling resources, but are not required to do so. Note that digital signatures may depend on the whitespace

There are differences to XML:

* There are no namespaces in the JSON representation
* The type of the resource is represented differently in JSON - instead of being the name of the base object (there is none in JSON), it is carried as the property "resourceType"
* The order of properties of an object is not significant in the JSON representation, though order within an array SHALL be maintained
* JSON does not have a notion of attributes versus elements, so attributes (id, value) are handled differently (see below)
* JSON has the array notation, which is used to represent repeating elements. Note that arrays are used when the item might repeat, even if it does not repeat in a specific instance
* The XHTML <div> element in the [Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) datatype is represented as a single escaped string of XHTML. This is to avoid problems in JSON with mixed content, etc. The XHTML SHALL still conform to the rules described for [the Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* There is no inherent support in JSON for a comment syntax. As a convention, content that would be comments in an XML representation is represented in a property with the name "fhir\_comments", which is an array of strings, which can appear on any JSON object. This is heavily used in example instances, e.g. in this specification, but not usually used in production systems (and production systems may choose to reject resources with comments in them)

The JSON format for the resources follows the standard XML format closely to make interconversion easy, and so that XPath queries can easily be mapped to query the JSON structures. However the differences - particularly the repeating element one, which cannot be avoided - mean that generic XML --> JSON converters are not able to perform correctly. The [reference platforms](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html#refimpl) provide XML <--> JSON conversion functionality that accommodates these FHIR-specific characteristics.

### JSON Representation for repeating elements

An element that has a maximum cardinality of >1 (e.g. x..\* in the definitions) may occur more than once in the instance. In XML, this is simply done by repeating the XML element multiple times. In JSON, this is done by using an array type. Note that:

* The name of the array is singular - the same as the XML element
* An item that may repeat is represented as an array even in the case that it doesn't repeat so that the process of parsing the resource is the same either way

<**coding**>

<**system** value="http://snomed.info/sct"/>

<**code** value="104934005"/>

</**coding**/>

<**coding**>

<**system** value="http://loinc.org"/>

<**code** value="2947-0"/>

</**coding**/>

is represented in JSON like this:

"coding": [

{

"system" : "http://snomed.info/sct",

"code" : "104934005"

},

{

"system" : "http://loinc.org",

"code" : "2947-0"

}

]

### JSON representation of primitive elements

FHIR elements with primitive values are represented in two parts:

* A JSON property with the name of the element, which has a JSON type of number, boolean, or string
* a JSON property with "\_" prepended to the name of the element, which, if present, contains the value's id and/or extensions (and comments, if there are any)

The FHIR types [integer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer) and [decimal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#decimal) are represented as a JSON number, the FHIR type [boolean](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#boolean) as a JSON boolean, and all other types are represented as a JSON string which has the same content as that specified for the relevant data type. Whitespace is always significant (i.e. no leading and trailing spaces for non-strings).

<**code** value="abc"/> <!-- code -->

<**date** value="1972-11-30"/> <!-- dateTime -->

<**deceased** value="false" /> <!-- boolean -->

<**count** value="23" /> <!-- integer -->

is represented in JSON as

"code" : "abc",

"date" : "1972-11-30",

"deceased" : false,

"count" : 23

When using a JavaScript JSON.parse() implementation, note that JavaScript natively supports only one numeric datatype, which is a floating point number. This can cause loss of precision for FHIR numbers. In particular, trailing 0s after a decimal point will be lost e.g. 2.00 will be converted to 2. The FHIR decimal data type is defined such that precision, including trailing zeros, is preserved for presentation purposes, and this is widely regard as critical for correct presentation of clinical measurements. Implementations should consider using a custom parser and big number library (e.g. <https://github.com/jtobey/javascript-bignum>) to meet these requirements.

If the value has an id attribute, or extensions, then this is represented as follows:

<**birthDate** id="314159" value="1970-03-30" >

<extension url="http://example.org/fhir/StructureDefinition/text">

<valueString value="Easter 1970"/>

</extension>

</**birthDate**>

is represented in JSON as:

"birthDate": "1970-03-30",

"\_birthDate": {

"id": "314159",

"extension" : [ {

"url" : "http://example.org/fhir/StructureDefinition/text",

"valueString" : "Easter 1970"

}]

}

Note: If the primitive has an id attribute or extension, but no value, only the property with the "\_" is rendered.

In the case where the primitive element may repeat, it is represented in two arrays. JSON null values are used to fill out both arrays so that the id and/or extension are aligned with the matching value in the first array, as demonstrated in this example:

<**code** value="au"/>

<**code** value="nz">

<extension url="http://hl7.org/fhir/StructureDefinition/display">

<valueString value="New Zealand a.k.a Kiwiland"/>

</extension>

</**code**>

is represented in JSON as:

"code": [ "au", "nz" ],

"\_code": [

null,

{

"extension" : [ {

"url" : "http://hl7.org/fhir/StructureDefinition/display",

"valueString" : "New Zealand a.k.a Kiwiland"

}]

}

]

Note: when one of the repeating elements has no value, it is represented in the first array using a null. When an element has a value but no extension/id, the second array will have a null at the position of that element.

Design Note: The representation of primitive data types has been split into two parts like this in order to simplify the representation of simple primitive values without id or extensions. This does have the cost of making the representation of the id attribute and extensions more ungainly, but these are both rarely used with primitive data types.

### JSON representation of Elements, and Complex Data types

Elements, and complex [datatypes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) (types that contain named elements of other types) are represented using a JSON object, containing a member for each element in the datatype. Composites can have id attributes, which are converted to JSON member values, in the same manner as described for primitives. For example:

<person>

<text>

<status value="generated" />

<div xmlns="http://www.w3.org/1999/xhtml"><p>...</p></div>

</text>

<name>

<use value="official" />

<given value="Karen" />

<family id="a2" value="Van" />

</name>

</person>

is represented in JSON as:

{

"person" : {

"name" : [{

"use" : "official" ,

"given" : [ "Karen" ],

"family" : [ "Van" ]

"\_family" : [ {"id" : "a2"} ]

}],

"text" : {

"status" : "generated" ,

"div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\"><p>...</p></div>"

}

}

Things to note here are:

* Both given and family are repeating XML elements, so they are serialised as an Array whether or not they repeat in this instance
* In the family part of 'name', the 'id' is added represented in \_family as described above
* The XHTML content in the 'div' element which is in the Narrative element 'text' is represented as an escaped string in the value property in JSON. The xhtml's root element needs to be a <div> in the xhtml namespace

### JSON representation of Resources

A resource is a JSON object with a property "resourceType" which informs the parser which resource type this is:

{

"resourceType" : "Patient",

"text" : {

"status" : "generated" ,

"div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\"><p>...</p></div>"

}

etc...

}

Note that parsers cannot assume that the resourceType property will come first.

**Design Note**: This is a problem for several JSON -> Object serialisers that assume that the resourceType property does come first, including [Json.NET](http://james.newtonking.com/json). However some JSON generators do not give the authoring application control of the order of the property values, and so these implementations cannot inter-operate with implementations that make assumptions about order. Given that JSON says that the property values are an unordered map of name/value pairs, this specification cannot require that properties come in any particular order, though implementers may choose to fix the property order if they are able (and the reference platforms provided with this specification do so).

There is [a sample file](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json-edge-cases.json) with many edge cases to help test JSON parsers.

### Canonical JSON

Resources and/or Bundles may be digitally signed (see [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) and [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html)).

This specification defines the following method for canonicalizing FHIR resources, when represented as JSON:

* No whitespace other than single spaces in property values and in the xhtml in the [Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* Order properties alphabetically
* Omit all properties that have a default value, if a default value is defined
* Omit all comments (fhir\_comments property as defined above)

This canonicalization method is identified by the URL http://hl7.org/fhir/canonicalization/json. The following additional canonicalization URLS are also defined:

|  |  |
| --- | --- |
| http://hl7.org/fhir/canonicalization/json#data | The narrative (Resource.text) is omitted prior to signing (note the deletion is at Resource.text, not Resource.text.div) |
| http://hl7.org/fhir/canonicalization/json#static | In addition to narrative (Resource.text), the Resource.meta element is removed. This makes the signature robust as the content is moved from server to server, or workflow and access tags are added or removed |
| http://hl7.org/fhir/canonicalization/json#narrative | The method only covers the Resource.id and Narrative is retained |

These canonicalization methods allow system the flexiibility to sign the various portions of the resource that matter for the workflow the signature serves.

Note: One consequence of signing the document is that URLs, identifiers and internal references are frozen and cannot be changed. This might be a desired feature, but it may also cripple interoperability between closed ecosystems where [re-identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html) frequently occurs. For this reason, it is recommended that systems consider carefully the impact of any signature processes. The impact of signatures on [Document bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) and their related processes is the most well understood use of digital signatures.

# license.html

## License and Legal Terms

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

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See also the specific warnings associated with [use of the DSTU](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\todo.html).

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Following is a non-exhaustive list of third-party artifacts and terminologies that may require a separate license:

|  |  |
| --- | --- |
| **Artifact/Terminology** | **Statement/Owner/Contact** |
| SNOMED CT | International Healthcare Terminology Standards Developing Organization ([IHTSDO](http://ihtsdo.org)). This specification includes content from SNOMED CT, which is copyright Â© 2002+ International Health Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7. Implementer use of SNOMED CT is not covered by this agreement |
| Logical Observation Identifiers Names & Codes (LOINC) | This material contains content from LOINC® (<http://loinc.org>). The LOINC table, LOINC codes, and LOINC panels and forms file are copyright © 1995-2014, Regenstrief Institute, Inc. and the Logical Observation Identifiers Names and Codes (LOINC) Committee and available at no cost under the license at <http://loinc.org/terms-of-use>. |
| International Classification of Diseases (ICD) codes | Consult the World Health Organization ([WHO](http://who.int)) |
| Current Procedures Terminology (CPT) code setAmerican Medical Association ([AMA](http://www.ama-assn.org/)) CPT copyright 2014 American Medical Association. All rights reserved. |  |

# lifecycle.html

## FHIR Life Cycle Page

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 3 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page describes several issues around lifecycle management for the resources and the content they contain. Specifically, this page describes:

* [Resource Status](#status): how resource status codes work
* [Current List](#current): issues associated with retrieving "current X list" of resources
* [Entered in Error](#error): information about how erroneous entry is handled for the resources

### Resource Status

Many FHIR resources have a status element that represents the lifecycle state of the resource or the clinical process represented by the resource. Work groups can specify status values appropriate to the individual resource. Although consistency between resources is not the primary objective, it is helpful to users and developers to have well-crafted value sets that cover all possible states (since the value sets are typically required and non-extensible).

To understand existing status elements, and to help create extensions and resources involving resource states, we note that status value sets follow one of the following life cycles:

* Clinical workflow process life cycle
* Request/Order life cycle
* Entity status life cycle
* Clinical status life cycle

### Clinical Workflow Process Life Cycle

Describes the lifecycle states of complex activities common in healthcare. Typically, these states follow a chronological life cycle that leads from initiation to the conclusion of the action. A characteristic (but non-exhaustive) set of states for the clinical workflow process life cycle include:

* planned â€“ resources for the activity are being allocated but the activity has not begun
* cancelled â€“ the planned activity did not start and will not take place
* in-progress â€“ the activity has begun
* on-hold (suspended) â€“ the activity has been temporarily interrupted
* stopped (aborted, failed) â€“ the activity has not been completed but no future action is planned
* completed (finished) â€“ the activity has been completed

Examples of the clinical workflow life cycle:

* Communication.status:
* Encounter.status:
* Goal.status:
* MedicationAdministration.status:
* MedicationDispense.status:
* Procedure.status:

### Request/Order Life Cycle

Some resources in FHIR represent orders or requests. The request lifecycle can be generalized in terms of four stages: creating the request, sending the request, receiving acceptance or refusal of the request, and fulfillment of the request. A characteristic (but non-exhaustive) set of states for the request/order pattern include:

* proposed: An actor (e.g. a clinical decision support system) has proposed an action to be requested
* draft: The request is in preliminary form, prior to being requested
* requested: The request has been been made
* rejected: The request receiver has declined the request
* accepted: The request receiver has accepted the request
* in-progress: Work to fulfill the request has begun
* on-hold (suspended): Work on the request has been interrupted
* stopped (aborted): The activity has not been completed but no future action is planned
* completed: Work on the requested task has been completed, and no further action is required
* cancelled: The request has been withdrawn

Examples of the request/order life cycle:

* CommunicationRequest.status:
* DeviceUseRequest.status:
* DiagnosticOrder.status:
* MedicationOrder.status:
* ProcedureRequest.status:
* ReferralRequest.status:

### Entity Availability Life Cycle

The entity availability life cycle indicates if the resource, or the entity described by the resource, is ready for use, not yet ready for use, or has been retired from use. A characteristic (but non-exhaustive) set of states for the entity availability life cycle include:

* draft: The entity is being prepared but is not yet in use
* active: The entity is in use
* suspended: The entity is not in use at the moment, but may return to active status
* amended: The entity has undergone a revision but is still active
* retired (superseded): The entity is no longer in use.

Examples of the entity availability life cycle:

* DiagnosticReport.status:
* MedicationStatement.status: . (note: in-progress and completed are states reflecting the administration of the medication)
* DocumentManifest.status:
* Conformance.status:
* StructureDefinition.status:
* DataElement:
* Questionnaire.status:
* DocumentReference.status:
* QuestionnaireResponse.status:
* Flag.status:
* Location.status:
* Organization.active:
* Patient.active:

### Clinical Status Life Cycle

Clinical status is somewhat different than the previous status values, since it does not deal with workflow or lifecycle. Instead, it indicates how evidence is affecting a clinical interpretation. Here are two examples:

* AllergyIntolerance.status:
* Condition.clinicalStatus:

### Current Resource Lists

Many clinical systems maintain current lists of some kind of resources for a patient. Some of the commonly maintained lists include:

* Current Problem List: a list of the problems that are of concern for care of the patient
* Current Medication List: a list of the medications that a patient is known to be on at the current time

Because of the way that resources are used, there is no simple way to determine, from examination of a resource, whether it is 'current' or not. Take, as an example, the [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) resource. In a typical EHR, condition resources might be published on the RESTful interface for the following reasons:

* to represent an item in a patient's curated problem list
* to represent a complaint or a diagnosis from an encounter record
* to represent a problem for investigation provided by a diagnostic system as part of a [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html)/[DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) pair
* the resources were received from another system as part of a referral package, and were current for that system when they were received

There is no element on the Condition resource than can convey the difference between these usages. In particular, there can be no way to differentiate between current and past current resources without having to retrospectively alter resources, which is problematic with regard to intergrity and digital signatures.

One consequnce of this is that searching the condition resource for a given patient will return more than just the patient's current problems. Though this is somewhat counter-intuitive to some implementers, restricting searches on Condition to only include the patient's current curated problem list excludes all the other - important - uses of the Condition resource.

Determining whether a Condition is an entry on a patient's current problem list is done by checking with the Condition resource is referenced from the correct list.

On the RESTful API, this is done using the [list search mechanism](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#current):

GET [base]/AllergyIntolerance?patient=42&\_list=$current-allergies

This is a request to fetch all the allergies in the patient 42's "Currrent Problem List". Note that the server is not required to actually make a resource representation of the current allergy list available, though doing so assists clients in their audit/integrity tasks. See [List Operation "Find"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list-operations.html#find) for further information.

In a document, current lists are determined by the code on a Composition section.

FHIR defines the following names for functional lists:

|  |  |  |  |
| --- | --- | --- | --- |
| **List** | **ResourceType** | **Description** | **Possible LOINC codes in documents / sections** |
| $current-problems | [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) | The "Currrent Problem List" - A list of current and active diagnoses as well as past diagnoses relevant to the current care of the patient | 46105-3 (Problem conditions Set) |
| $current-medications | [MedicationStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationstatement.html)/ [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) | A list of all medications that the patient is taking. The 'current medications list' sometimes may in clude a mix of prescribed and over-the-counter medications - or only some of them. The list may contain a mix of [prescriptions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) and more general [statements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationstatement.html), or only one of the two. The list may also correspond to a formal reconciled medication administration schedule, but more often does not | 57828-6 (Prescription list), 10160-0 (History of medication) |
| $current-allergies | [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) | A list of known or suspected propensities to medications, foods, or environmental agents that is provided to help prevent reactions while care is occurring | 18716-1 (Allergy studies (set)), 52472-8 (Allergies and Adverse Drug Reactions), and 48765-2 (Allergies and adverse reactions Document) |
| $current-drug-allergies | [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) | A list of known or suspected propensities to medications that is provided to help prevent reactions while care is occurring. This list is a subset of the full allergies list | (same as above?) |

### Entered In Error Summary

The entered-in-error state indicates the resource was created accidentally, and should be ignored. This state can apply to resources created by manual entry. It is usually not associated with the Clinical Workflow Process life cycle, but can be associated with the Request/Order and the Entity Availability life cycles.

This table summarises what is expected to happen for each resource in the case that the data it contains is subsequently found to be an erroneous entry.

Note: Resources that are not listed in this table do not have any explicit documentation with regard to being entered in error.

# logical.html

## Logical Models

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

A logical model is a expression of a set of content in a FHIR ready style that helps implementers understand the content is a single package. Because of the way FHIR works, a single logical model may be actually represented during exchange by a set of resources, including a series of observations and questionnaires. Typically, profiles that define how the resources are used are derived from the logical model.

ToDo: figure out how all this happens.

# loinc.html

## Using LOINC with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | LOINC is made available by the [Regenstrief Institute](https://www.regenstrief.org/) at <http://loinc.org> |
| System | The URI <http://loinc.org> identifies LOINC codes |
| Version | Where a version is used, it should be the standard LOINC version e.g. 2.48 |
| Code | The LOINC Code Identifier e.g. 21176-3. LOINC codes are not case sensitive. In addition, LOINC part codes and LOINC answer string ids can be used where appropriate |
| Display | Use either the SHORTNAME or LONG\_COMMON\_NAME field for the display |
| Filter Properties | Several properties are defined as described below |

### Copyright Issues

The terms of use for LOINC require that a [notice](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\license.html#loinc) be included with any use of LOINC codes. This notice must appear in the *copyright* element of any value set that includes LOINC codes (either in the code or filter elements, or in an expansion):

<copyright value="This content LOINCÂ® is copyright Â© 1995 Regenstrief Institute, Inc. and the LOINC Committee, and available at no cost under the license at http://loinc.org/terms-of-use"/>

Additional copyright statements may also be found in the *copyright* element. Some LOINC codes have 3rd party copyright statements. When these codes are included in a value set, they must carry their own copyright statement as well.

### Case Sensitivity

For comparison purposes, LOINC codes, displays, and property values are not case sensitive, though implementers SHOULD maintain the correct case when using LOINC codes and property values.

### Use of LOINC PARTS

As described in the [LOINC Manual](http://loinc.org/downloads/files/LOINCManual.pdf) section 10.2, LOINC Parts are a coded representation of a value for a dimension used to specify a LOINC Term which are assigned a non-semantic identifier with a â€œLPâ€ prefix and a mod-10 check digit. Following the LOINC license, these part codes may be used in the following ways:

* In filter properties, as described below
* In [Structure Definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition-definitions.html), where the structure describes the use of a set of LOINC codes
* In a [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) resource, where mappings between LOINC codes and other codes are being defined

Part codes are the same LOINC system(http://loinc.org), and SHALL be represented in uppercase (e.g. LP31755-9).

### Use of LOINC Answer Lists

LOINC also allocates Answer List and Answer String Ids for use in various forms and questionnaires. LOINC Answer String IDs are also valid LOINC codes:

<coding>

<system value="http://loinc.org"/>

<code value="LA11165-0"/>

<display value="Platelet anisocytosis"/>

</coding>

LOINC Answer List Ids are actually value set identifiers. See [below](#alist) for how to use these.

### LOINC Filter Properties

This section documents the property filters that can be used with the LOINC code system in value set composition statements.

#### LOINC Property filter

|  |  |
| --- | --- |
| Description | Allows the selection of a set of LOINC codes with a common property value |
| Property Name | One of the names listed in the "Field Name" column in LOINC Database Structure (Appendix A of the LOINC manual) |
| Operations Allowed | = / regex |
| Values Allowed | [string value] |
| Comments | The 6 properties COMPONENT, PROPERTY, TIME\_ASPCT, SYSTEM, SCALE\_TYP, and METHOD\_TYP are most likely to be useful. |

#### 3rd Party Copyright

|  |  |
| --- | --- |
| Description | Allows for the inclusion or exclusion of LOINC codes that include 3rd party copyright notices |
| Property Name | copyright |
| Operations Allowed | = |
| Values Allowed | LOINC | 3rdParty |
| Comments | LOINC = only codes with a sole copyright by Regenstrief. 3rdParty = only codes with a 3rd party copyright in addition to the one from Regenstrief. |

#### Multi-Axial Hierarchy

|  |  |
| --- | --- |
| Description | Allows for the selection of a set of codes base on their appearance in the LOINC multi-axial hierarchy |
| Property Name | parent | ancestor |
| Operations Allowed | = / in |
| Values Allowed | Part Code (or, for "in", multiple part codes separated by commas) |
| Comments | "parent" selects immediate parents only. For example, the code "44022-2" has the parent "LP52960-9". Ancestor includes parents transitively, e.g. "LP52960-9" eventually has a parent "LP31755-9", so the code "44022-2" is in the set of codes that have ancestor=LP31755-9 |

*TODO: Document Ontology*

### Implicit Value Sets

Implicit value sets are those whose specification can be predicted based on the grammar of the underlying code system, and the known structure of the URL that refers to them. LOINC defines one sets of implicit value sets: By Multi-Axial Hierarchy Entry.

If any value set resources exist with an identifier that conforms to the URL patterns specified below, the content of the resource must conform to the template provided. Profiles and other value set references are allowed to reference these value sets directly. *todo: can LOINC actually host a service that returns these?*

The value set identifier http://loinc.org/vs is a value set that contains all LOINC codes.

#### LOINC Answer List

LOINC defines a set of Answer lists, each of which contains a set of LOINC codes. LOINC answer lists are value sets. The value set identifier "http://loinc.org/vs/[id]" identifies a value set that contains a set of LOINC codes. For instance, the value set identifier http://loinc.org/vs/LL715-4 has the following definition for LOINC 2.52:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

[some html that identifies that this value set

includes all LOINC codes in this answer list]

</div>

</text>

<identifier value="http://loinc.org/vs/LL715-4"/>

<version value="2.52"/>

<name value="Platelet morph"/>

<description value="LOINC Answer List for Platelet morph"/>

<status value="active"/>

<date value="[optional date of LOINC release]"/>

<compose>

<include>

<system value="http://loinc.org"/>

<concept>

<code value="LA11165-0"/>

<display value="Platelet anisocytosis"/>

</concept>

<concept>

<code value="LA11168-4"/>

<display value="Platelet clump"/>

</concept>

<concept>

<code value="LA11167-6"/>

<display value="Platelet large fragments"/>

</concept>

<concept>

<code value="LA11166-8"/>

<display value="Platelet satellitism"/>

</concept>

<concept>

<code value="LA11169-2"/>

<display value="Platelets.agranular"/>

</concept>

<concept>

<code value="LA11170-0"/>

<display value="Platelets.giant"/>

</concept>

<concept>

<code value="LA11172-6"/>

<display value="Platelets.large"/>

</concept>

<concept>

<code value="LA11171-8"/>

<display value="Platelets.small"/>

</concept>

</include>

</compose>

</ValueSet>

Here is an example of a LOINC Answer list used in a Questionnaire question:

<question>

<concept>

<system value="http://loinc.org"/>

<code value="11125-2"/>

<display value="Plat morph Bld"/>

</concept>

<type value="choice"/>

<options>

<reference value="http://loinc.org/vs/LL715-4"/>

</options>

</question>

#### Multi-Axial Hierarchy Entry

A value set with an identifier of "http://loinc.org/vs/[partcode]" must conform to this template, where [partcode] is a part code from the multi-axial hierarchy:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

[some html that identifies that this value set

includes all LOINC codes subsumed by the identified

Multi-Axial Heirarchy Part Code]

</div>

</text>

<identifier value="http://loinc.org/vs/[partcode]"/>

<version value="[optional - but strongly recommended - LOINC version]"/>

<name value="LOINC Value Set from Multi-Axial Heirarchy code [partcode]"/>

<description value="All LOINC codes for [partcode or name]"/>

<status value="active"/>

<date value="[optional date of LOINC release]"/>

<compose>

<include>

<system value="http://loinc.org"/>

<filter>

<property value="ancestor"/>

<op value="="/>

<value value="[partcode]"/>

</filter>

</include>

</compose>

</ValueSet>

# managing.html

## Managing Resource Identity

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Each resource has a known identity, which is a URL. The identity is not stored inside the resource, but must be tracked by systems handling resources. For RESTful systems, the resource identity is the same as the URL by which it is found. When a resource is packaged in a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) (e.g. for [messages](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html) or [documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html), or [exchanged in a service](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html)), the id is included along with the resource. When systems using FHIR resources are deployed in an implementation context where there is more than two systems exchanging resources, the way that resources are identified with URLs needs to be managed carefully.

Note that many resources also have an identifier element, and usually there can be multiple identifiers. This identifier is a logical identifier for the concept that the resource describes, and is different to the identity discussed in this section, which is the literal identity of the resource. Note that there are often multiple resource instances that describe the same concept across multiple systems, e.g. each application keeps its own copy of the patient information in a [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource. This can even exist within a single system, such as in the case of [patient duplicates](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#links)).

### Using Resources

Resources are used in a variety of circumstances. Generally, these can be categorized into 3 different scenarios:

1. **Closed Trading System**: the resources are only ever exchanged between fixed systems in a tightly controlled community, such as a single EHR system with multiple modules. There is only one master server for each resource type, and resources are managed by that server. In this context, the [logical id](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) of a resource is sufficient to fully identify the resource
2. **Open system**: there are many peer servers, each managing a set of resources of different types. In order to identify resources, a full URL reference to the origin server is required. The grand example of an open system is the World Wide Web
3. **Partially closed, inter-linked systems**: a mixture of both closed and open systems - trading communities that are tightly managed, but have managed interactions with other closed trading systems, or with the world-wide web, or both. In fact, this combination appears to be the most likely scenario for current real-world healthcare business solutions

These combinations are why either relative (logical) or absolute references are allowed, and why a logical id is always required, in order to enable seamless exchange amongst partially closed trading systems.

### Copying Resources and Re-identification

When resources are exchanged between systems, they may need to be re-identified (i.e. assigned a new logical resource id). When a resource is re-identified, nothing in the resource changes, but any references that point to the resource need to be updated. Whether re-identification is required or not depends on the context, as does how resource references are updated.

The normal case is that a client/receiving system accepts the server/sender's identification of a resource at face value, whether it is a relative or absolute reference. When the client/receiver wants to follow resource references, they are done using the server id (typically either by http calls or locating them in a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle)), but other arrangements are possible. In such cases, there is no need for re-identification.

Another scenario is for a client to retrieve a resource from a server, and make its own local persistent copy. If the local resource has a life-cycle of its own (i.e. it is not just a cached resource), then it needs to have its own identity; i.e. the resource must be re-identified. The simplest case is that the client only is keeping local copies of resources from a single server. In these cases, the client can simply replace the root URL and keep the logical id of the resource the same. In fact, if the server is using relative references, then this change doesn't involve any actual changes to the resources, it only means a re-interpretation of the references.

In some cases, however, the client may deal with multiple servers. In this case, the logical id of the resource is not guaranteed to be unique (unless all resources have a UUID for the logical id, which is allowed but not required). When the client cannot be sure that the resource identities are unique, it will have to re-identify the resources. In practice this means that the client needs to keep some kind of identity translation table, and update references to the resources it has copied locally when other resources are received.

The case of a gateway system that migrates resources from one ecosystem to another is very similar. In some limited cases, it can leave the logical id of the resources unchanged as resources are copied from one closed system to another. However in more complicated cases, it will have to modify the resource references as resources pass across the gateway.

**DSTU Note:** In its current form, FHIR allows various convenient implementer practices around resource identification that make integration across eco-system boundaries more difficult. In particular, either only allowing UUIDs for logical IDs or only allowing absolute references would make the boundary management problem easier but remove useful and convenient flexibility for other uses of FHIR.

Feedback is welcome [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

# messaging.html

# Messaging using FHIR Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR Resources can be used in a traditional messaging context, much like HL7 v2 (see [detailed comparison](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison-v2.html)). Applications asserting conformance to this framework claim to be conformant to "FHIR messaging" (see [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html)).

In FHIR messaging, a "request message" is sent from a source application to a destination application when an event happens. Events mostly correspond to things that happen in the real world. The request message consists of a [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) identified by the [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) "message", with the first resource in the bundle being a [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource. The MessageHeader resource has a code - the message event - that identifies the nature of the request message, and it also carries additional request metadata. The other resources in the bundle depend on the type of the request.

The events supported in FHIR, along with the resources that are included in them, are defined below.

The destination application processes the request and returns one or more response messages which are also a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) of resources identified by the [type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.type) "message", with the first resource in each bundle being a [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource with a response section that reports the outcome of processing the message and any additional response resources required.

* Example Request Message: TODO
* Example Response Message: TODO

## Basic Messaging Assumptions

This specification assumes that content will be delivered from one application to another by some delivery mechanism, and then one or more responses will be returned to the source application. The exact mechanism of transfer is irrelevant to this specification, but may include file transfer, http based transfer, MLLP (HL7 minimal lower layer protocol), MQ series messaging or anything else. The only requirement for the transfer layer is that requests are sent to a known location and responses are returned to the source of the request. This specification considers the source and destination applications as logical entities, and the mapping from logical source and destination to implementation specific addresses is outside the scope of this specification, though this specification does provide a direct delivery mechanism below.

The agreements around the content of the messages and the behavior of the two applications form the "contract" that describes the exchange. The contract will add regional and local agreements to the rules defined in this specification.

This specification ignores the existence of interface engines and message transfer agents that exist between the *source* and *destination*. Either they are transparent to the message/transaction content and irrelevant to this specification, or they are actively involved in manipulating the message content (in particular, the source and destination headers are often changed). If these middleware agents are modifying the message content, then they become responsible for honoring the contract that applies (including applicable profiles) in both directions.

A key aspect of a message is the impact of its content:

Some Events defined by FHIR are assigned to one of these categories, but others are not able to be categorized in advance, and the category must be determined by the content, or the context.

### Message Exchange Patterns

Each FHIR request message has one or more response messages. There must be at least one response message so that the sender can know that the message was properly received. Multiple response messages SHALL NOT be returned for messages of consequence, and SHOULD not be returned for notifications.

In principle, source applications are not required to wait for a response to a transaction before issuing a new transaction. However in many cases, the messages in a given stream are dependent on each other, and must be sent and processed in order. In addition, some transfer methods may require sequential delivery of messages.

For this reason, a synchronous exchange pattern - where the sender sends a message, and waits on the same channel for a single response, and then sends the next message - is the easiest to understand and manage. The [$process-message](#process) [operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) described below works in this fashion.

However synchronous message exchange does not cater for multiple response messages, which may arise when processing queries, and also imposes through-put limitations which may become relevant at high volumes. Additionally, it may not be practical or appropriate to wait for response messages. In these cases, the asynchronous message pattern [described below](#async) should be used.

### MessageHeader Identifiers

An incoming message contains two identifiers: the Bundle.id and the [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html).id. Each time a new message is created, it SHALL be assigned an identifier (MessageHeader.id) that is unique within that message stream. Note that since message streams are often merged with other streams, it is recommended that the identifier should be globally unique. This can be achieved by using a UUID or an OID. Each time a message is sent, the Bundle.id should be changed to a new value.

When a receiver receives and processes the message, it responds with a new message with a new identifier, wrapped in a bundle which also has a new id. The response message also quotes the request MessageHeader.id in MessageHeader.response.identifier so that the source system can relate the response to its request.

### Absence of Reliable Messaging

Some of the message delivery mechanisms mentioned above are reliable delivery systems - the message is always delivered, or an appropriate error is returned to the source. However most implementations use methods which do not provide reliable messaging, and either the request or the response can get lost in transit. FHIR messaging describes a simple approach that receivers SHOULD conform to in order to handle the absence of reliable messaging that maintains predictable functionality.

If the sender of the message implements reliable messaging, it SHALL do the following when it receives no response to a message within a configured timeout period:

|  |  |
| --- | --- |
| Consequence | Resend the same message (with the same MessageHeader.id) with the same Bundle.id |
| Currency | Resend the same message (with the same MessageHeader.id) with a different Bundle.id |
| Notification | Resend the same message (with the same MessageHeader.id) with a different Bundle.id |

When a receiver implements reliable messaging, it SHALL check the incoming Bundle.id and MessageHeader.id against a cache of previously received messages. The correct action to take depends on what is received:

|  |  |
| --- | --- |
| Both the Bundle.id and MessageHeader.id have not been received | This is the normal case, and the message should be processed |
| Both envelope and message already received | The original response has been lost (failed to return to the request issuer), and the original response SHALL be resent |
| The MessageHeader.id has already been received, but the Bundle.id is new | A previously seen message has been resubmitted for processing again. The server may either reprocess the message, or reject the message |
| The Bundle.id has already been received, but the MessageHeader.id is new | This is an error - Bundle.id values should never be reused |

The duration period for caching does generally not need to be very long. At a minimum, it could be 1 minute longer than the timeout of the sending system, though it may need to be longer depending on the re-sending policies of the sending system.

Applications that implement reliable messaging declare their reliable cache period in their [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html).

#### Example: Consequence

In the first example, a Clinical EHR issues an order for a particular imaging examination to be performed on a patient. This is considered to be a message of **Consequence**: multiple orders should not be created (in practice there are usually human review processes that catch multiple orders, but repeat orders create entropy in the system that is harmful). The EHR sends a message where the Bundle.id is UUID 1 (72edc4e0-6708-42ab-9734-f56721882c10), with a MessageHeader.id of UUID 2 (dad53a57-dcb4-4f18-b066-7239eb4b5229).

The EHR system never receives a response to the message; it does not know whether the request message got lost, or the imaging management systems was unable to process the request, or whether it successfully processed the message and the response was lost. In this case, the EHR system resends the message with same two identifiers.

In this case, the imaging system successfully received the message, and processed it. Because it receives the resent order after 1 minute (which is within its 15 minute cache time), and the two UUIDs 1 and 2 match a message it has already processed, it knows that it already processed the order, and simply returns the previous response. In the case of additional resent queries, the application keeps sending the original response, though it may also alert system administrators that the same original message keeps being resent, since lost messages should be a rare occurrence.

When the EHR system finally receives the message, it knows how the imaging management system responded; it can be sure because the message id from the original request is echoed in the response portion of the returned message.

#### Example: Currency

In this second example, a Clinical EHR needs to know what appointment slots are available for a particular imaging procedure. This is a message of **Currency**: available slots are ever disappearing, and ordering a slot that has become unavailable is a waste of time for the humans and systems involved. The EHR sends a message where the Bundle.id is UUID 3 (4c7f5cb2-5964-4d42-b719-e0227461818c), with a MessageHeader.id is UUID 4 (63ed7d68-b2cc-421d-ba1c-a6c7785581f2).

The EHR system never receives a response to the message; it does not know whether the request message got lost, or the imaging management systems was unable to process the request, or whether it successfully processed the message and the response was lost. In this case, the EHR system resends the message with same MessageHeader.id (UUID 4), but creates a new Bundle.id (c7c17fe4-9560-49c7-b2ae-42636476fb86).

In this case, the imaging system successfully received the message, and processed it. When it receives the resent order after 1 minute (which is within its 15 minute cache time), it sees that although the message id is the same, the Bundle.id has changed, and it reprocesses the message again, and sends a new response.

When the EHR system finally receives the message, it knows the current slot availability on the imaging management system responded.

Note that the existence of active intermediaries (or "middleware") creates the need for this protocol - the original sender matches the response to the request based on the MessageHeader.id, and so an active intermediary that choose the re-initiate a query that it previously relayed cannot change the MessageHeader.id. This protocol avoids the need for the MessageHeader.id to change, and only requires change to the Bundle.id which is never the basis for context linking outside the immediate message exchange protocol described here.

## Conformance Statement

Applications may only assert conformance to "FHIR messaging" if they publish a conformance statement so the claim may be verified. A conformance statement lists all the message events supported (either as sender or receiver) and for each event, a profile that states which resources are bundled (sender), or are required to be bundled (receiver), and any rules about the information content of the individual resources. The conformance statement is a [resource with the name "Conformance"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html).

## $process-message

The simplest way to handle messages where there are also [RESTful interactions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) occurring is to use the [$process-message](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader-operations.html). This operation that accept a messages, processes it according to the definition of the event in the message header, and returns a one or more response messages. e.g. In addition to processing the message event, a server may choose to retain all or some the resources and make them available on a RESTful interface, but is not required to do so.

When processing messages, a server may return a status code of 200 OK, or an process/error code (300+). If the server returns 200 OK, it SHALL return a bundle that is the message response. For any other response code, the message has not been succesfully processed. The server MAY return an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) with additional information, and SHOULD do so if the response code is 400 or greater. The client SHALL interpret a 4xx response to indicate that there is no point resubmitting the unaltered message, and a 5xx response to indicate an unexpected error occurred on the part of the server, with the implication that it may be appropriate to resubmit the original message. Doing so SHOULD NOT result in a duplicate message response). Repeated failures indicate either a fatal problem with the submission or a problem with the receiving application.

The following rules apply when using $process-message:

* The operation only accepts POST transactions - any other HTTP method will result in an HTTP error
* The request content type submitted is always [a Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) with type "message" containing a [Message Header](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource as the first resource
* The response content type returned is always [a Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) with type "message" containing a [Message Header](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource as the first resource, or an HTTP error
* If the response is an error, the body SHOULD be an [Errors & Warning](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource with full details
* The mailbox may be authenticated using standard HTTP authentication methods, including OAuth

The $process-message operation can be used by any HTTP end point that accepts FHIR messages, not just FHIR RESTful servers.

In order to ensure consistency of processing, the [logical rules regarding processing of Bundle.id and message id described above](#reliable) SHALL be followed when messages are processed using this operation.

The [$process-message](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader-operations.html) operation may be used synchronously, or asynchronously.

### Synchronous Operation

Synchronous messaging is the easiest to understand; the sender sends a message to the receiver (the server), the server processes it, and then returns a response. Usually (though not always) the sender waits for the response to the current message before sending the next message. This kind of messaging exchange is the most common because it's the simplest to understand.

The following rules apply when using the $process-message operation synchronously:

* The URL (http://server/base/$process-message) has no parameters
* It is an error if the sender POSTs a message that requires multiple response messages
* Servers SHALL accept multiple concurrent message submissions and process them correctly (they are allowed to process them sequentially internally, but multiple concurrent submissions is not an error in its own right)

### Asynchronous Operation

in Asynchronous messaging, the server acknowledges receipt of them message immediately, and responds to the sender separately. The server may respond more than once to any given message.

The following rules apply when using the $process-message operation synchronously:

* The URL has at least one parameter: http://server/base/$process-message?async=true
* The server acknowledges the message with a 200OK with no body, or returns an HTTP error if the message cannot be processed. An [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) SHOULD be returned in such a case
* Accepting the message means that the server has understood the message enough to know where to respond
* By default, the server responds by invoking the $process-message using the sender's stated end-point in the message: POST [MessageHeader.source.endpoint]/$process-messages]
* Since the source end point may be manipulated by message transfer engines, an alternative response address may be specified using the parameter "response-url": http://server/base/$process-message?async=true&response-url=http://server2.com/base/anything. The endpoint at the specified URL SHALL implement the signature of the $process-message operation (parameter async=true, accept a Bundle, return a 200 OK or an error)
* The server submits response messages to the appropriate end point with the parameter async=true. There is no response message for the response messages

When a message is received, a receiver can determine from the content of the message header whether it's a new message to process, or a response to a message that has already been sent. Note that asynchronous messaging is less reliable than synchronous messaging; more can go wrong. This specification does not dictate any particular error handling protocols or responsibilities; these are left to trading partner agreements between implementers.

## Relationship between Messaging and REST

As well as this messaging framework documented here, FHIR also defines a [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html). The messaging and RESTful frameworks are related in that both share the same set of resources on which they operate. In fact, the basic [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) resource that the messaging framework is implemented is itself a resource that can treated in a RESTful approach.

The kinds of functionality that the RESTful API and the messaging framework offer are very similar; their primary difference is architectural in nature.

For instance, the messaging framework defines an event for notifying that a administration resource has been created or updated; the REST API offers similar services ([history](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#history) and [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html)). On the other hand, there are differences in the capabilities offered - while a patient merge can be implemented as a series of RESTful operations performed by the client that update all resources linked to the patient, when a message command to merge patient records is processed, the server will do all the work, and is also able to merge in areas not exposed on the RESTful API. The REST API, however, provides a set of basic operations on all resources that would need special definitions in the messaging framework - definitions that are not provided.

There is no expectation that RESTful systems will need to offer messaging support, or vice versa, though systems may find it useful to support both sets of functionality in order to satisfy a wider range of implementers.

As a resource that can be used with the RESTful framework, the MessageHeader resource has the normal resource end-point (/MessageHeader), which is used to manage a set of static message resources. This could be used to make an archive of past messages available. **Creating or updating MessageHeader resources in this fashion does not represent the actual occurrence of any event, nor can it trigger any logic associated with the actual event.** It is just for managing a set of message header resources.

### Asynchronous Messaging using the RESTful API

It is possible to exchange messages using the RESTful end-point as a central point of exchange. This is not particularly efficient compared to other methods, but is useful for low-volume axynchronous exchange.

To send a message, a sender posts the message bundle to the /Bundle end point, with a uri that identifies the receiver at [MessageHeader.destination.endpoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader-definitions.html#MessageHeader.destination.endpoint). The RESTful server accepts the bundle, stores it as a single bundle, and indexes it on the [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html).

To receive messages, a receiver searches for all messages destined for itself, since it's last check:

GET [base]/Bundle?message.destination-uri=[rcv]&\_lastUpdated=>2015-03-01T02:00:02+01:00

The receiver works through the response, processing each message. As each message is processed, the receiver creates a response message, reversing the source and destination, and posts it back to the server.

To check for responses, the original sender searches for response messages destined for itself, since it's last check:

GET [base]/Bundle?message.destination-uri=[snd]&message.response-id:missing=false

&\_lastUpdated=>2015-03-03T06:03:522+01:00

This lightweight protocol needs ongoing administration to ensure that multiple parties do not interfere with each other by re-using the same system identifier (and against malicious attack).

## Event List

The *message.code* element carries a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) that identifies the event that the message conveys. This table lists the message event codes defined in this specification (the system value for these is "[http://hl7.org/fhir/message-events](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-message-events.html)"):

The request and response details: The column values are either a resource that is included as part of the response, or an element that refers to another resource, which means that the target of these references SHALL also be in the message. In this table, the request and response columns list the focus resource for the event, along with other resources that should also be carried in the message directly (if they exist).

**DSTU Note:** Additional events may be defined elsewhere, though this specification does not yet define how.

Feedback is sought [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

## Invoking Operations via Messages

A message can be used to invoke an operation as defined for a RESTful interface using an operation definition. To invoke an operation using a message:

* The requester sends a message (a bundle with type = message, and a message header resource)
* The message header has an event.system of urn:ietf:rfc:3986
* The event.code is the URL from the operation definition OperationDefinition.url
* The MessageHeader.data refers to a [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) resource
* The parameters resource is populated appropriately as specified by the nominated operation definition

The recipient executes the operation as specified, and then:

* The receiver sends a message (a bundle with type = message, and a message header resource)
* The message header has the same event as the original message
* The MessageHeader contains a response that refers to the original request message, and a code for the outcome, with details if the operation failed
* The MessageHeader.data refers to a [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) resource
* The parameters resource is populated appropriately as specified for the response by the nominated operation definition
* If the operation definition specifies a single return, then this is returned as the target of the MesssageHeader.data directly

Here's an example:

<Bundle xmlns="http://hl7.org/fhir">

<id value="urn:uuid:77831928-2a35-4c08-9496-8232323bf48c"/>

<!-- normal bundle stuff -->

<entry>

<fullUrl value="urn:uuid:6080d4a7-5e05-45dc-96d5-f75329564d1f"/>

<resource>

<MessageHeader>

<id value="cac8143e-6138-4f45-b086-bb8ebf976aae">

<!-- normal message header stuff -->

<event>

<system value="urn:ietf:rfc:3986"/>

<!-- value set expansion -->

<code value="http://hl7.org/fhir/OperationDefinition/ValueSet-expand"/>

</event>

<!-- more normal message header stuff -->

<data>

<reference value="urn:uuid:00213637-dc7c-40d2-a7de-f4ef1eea5685"/>

</data>

</MessageHeader>

</resource>

</entry>

<entry>

<fullUrl value="urn:uuid:00213637-dc7c-40d2-a7de-f4ef1eea5685"/>

<resource>

<Parameters>

<parameter>

<name value="identifier"/>

<valueUri value="http://hl7.org/fhir/ValueSet/identifier-type"/>

</parameter>

</Parameters>

</resource>

</entry>

</Bundle>

Note that there's no way to anchor the execution of the operation against a URL. The only operations that can be executed in this way are defined to be executed at the System or Resource level for a particular resource.

### Invoking Search via Messages

In the same way that a defined operation can be invoked, a regular search operation can be invoked. This also uses the [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) resource, with the following rules:

* The event code is "search-type" or "search-system" in the system http://hl7.org/fhir/restful-interaction
* If the event type is "search-type" there SHALL be a parameter "resourceType" with specifies the type of resource being searched
* The search parameters are converted to FHIR data types according to the following table

|  |  |
| --- | --- |
| **Search Parameter Type** | **Data Type** |
| number | integer |
| date | dateTime |
| string | string |
| token | string or Coding (split the system and code apart) |
| reference | uri |
| composite | string |
| quantity | string or Quantity (split the syntax out) |
| uri | uri |

Here's an example:

<Bundle xmlns="http://hl7.org/fhir">

<id value="urn:uuid:77831928-2a35-4c08-9496-8232323bf48c"/>

<!-- normal bundle stuff -->

<entry>

<fullUrl value="urn:uuid:c466754c-09c0-4f59-9f76-a48bd0ea27c9"/>

<resource>

<MessageHeader>

<!-- normal message header stuff -->

<event>

<system value="http://hl7.org/fhir/restful-interaction"/>

<!-- Search against Patient -->

<code value="search-type"/>

</event>

<!-- more normal message header stuff -->

<data>

<reference value="urn:uuid:59a17a19-46eb-42d9-821a-f93a0c530cac"/>

</data>

</MessageHeader>

</resource>

</entry>

<entry>

<fullUrl value="urn:uuid:59a17a19-46eb-42d9-821a-f93a0c530cac"/>

<resource>

<Parameters>

<parameter>

<name value="resourceType"/>

<valueString value="Patient"/>

</parameter>

<parameter>

<name value="gender"/>

<valueString value="m"/>

</parameter>

</Parameters>

</resource>

</entry>

</Bundle>

# narrative-definitions.html

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

# narrative-example.html

# Example Narrative

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

## Plain HTML, No Styles

### Heading 3

#### Heading 4

##### Heading 5

###### Heading 6

Paragraph. span. [Link](#link). **Bold**, br:  
em, *Italics*, **strong**, small, big Teletype Text, small, Definition term, q, var. All provided by HL7, for FHIR (cite).

Paragraph in a blockquote, with an hr after it:

Paragraph in a div (Link Target)

* Unordered List Item

1. Ordered List Item

DT Item

DD Item

Some Pre Text

with a line break

Table:

| Table Caption | | |
| --- | --- | --- |
| **Head Cell 1** | **Head Cell 2** | **Head Cell 3** |
| Foot Cell 1 | Foot Cell 2 | Foot Cell 3 |
| Body Cell 1 | Body Cell 2 | Body Cell 3 |

Code Block Sample Block

## External Styles

### Text:

Example Text: **bold**, *italics*, underline and ~~strikethrough~~

This paragraph is left aligned. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen.

This paragraph is right aligned. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen.

This paragraph is center aligned. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen.

This paragraph is justified. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen.

### Table:

|  |  |  |  |
| --- | --- | --- | --- |
| Border Left | Border Right | Border Top | Border Bottom |

### List:

1. arabic (Item 1)
2. Item Two
3. little-roman (Item 1)
4. Item Two
5. big-roman (Item 1)
6. Item Two
7. little-alpha (Item 1)
8. Item Two
9. big-alpha (Item 1)
10. Item Two

* disc (Item 1)
* Item Two
* unlist(Item 1)
* Item Two
* circle (Item 1)
* Item Two
* square (Item 1)
* Item Two

## Internal Styles

Example Text: **bold**, italics, underline and ~~strikethrough~~. Font-Family Serif and Sans Serif, Font-size 50% 80% 150%, Font-Color Navy Maroon Brown, Background-color Aqua Silver Pink.

Whitespace Control:

Normal Whitespace Test, long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long sentence

No-Wrap Whitespace Test, long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long sentence

Pre Whitespace

Test, long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long sentence

Pre-Line Whitespace Test, long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long sentence

Pre-Wrap Whitespace Test, long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long long sentence

This paragraph is left aligned. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen. The content should be laid out aligned at the left of the screen.

This paragraph is right aligned. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen. The content should be laid out aligned at the right of the screen.

This paragraph is center aligned. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen. The content should be laid out aligned at the center of the screen.

This paragraph is justified. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen. The content should be laid out aligned at both the left and right of the screen.

1. armenian (Item 1)
2. Item Two
3. cjk-ideographic (Item 1)
4. Item Two
5. decimal (Item 1)
6. Item Two
7. decimal-leading-zero (Item 1)
8. Item Two
9. georgian (Item 1)
10. Item Two
11. hebrew (Item 1)
12. Item Two
13. hiragana (Item 1)
14. Item Two
15. hiragana-iroha (Item 1)
16. Item Two
17. inherit (Item 1)
18. Item Two
19. katakana (Item 1)
20. Item Two
21. katakana-iroha (Item 1)
22. Item Two
23. lower-alpha (Item 1)
24. Item Two
25. lower-greek (Item 1)
26. Item Two
27. lower-latin (Item 1)
28. Item Two
29. lower-roman (Item 1)
30. Item Two
31. none (Item 1)
32. Item Two
33. upper-alpha (Item 1)
34. Item Two
35. upper-latin (Item 1)
36. Item Two
37. upper-roman (Item 1)
38. Item Two
39. upper-roman (Item 1)
40. Item Two

# narrative.html

## Narrative

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 3 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Any resource that is a [domain resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\domainresource.html) (almost all types of resource) MAY include a human-readable narrative that contains a summary of the resource, and may be used to represent the content of the resource to a human. If narrative is present, it SHALL reflect all content needed for a human to understand the essential clinical and business information otherwise encoded within the resource. Resource definitions may define what content should be represented in the narrative to ensure clinical safety.

The narrative for a resource is allowed to contain additional information that is not in the structured data, including human-edited content. Such additional information SHALL be in the scope of the definition of the resource, though it is common for the narrative to include additional descriptional information extracted from other referenced resources. Narrative for a resource should include summary information about referenced resources as necessary for a consumer of the resource to be able to understand the key essential information about a resource without retrieving additional resources. For example, the narrative for a MedicationOrder might include brief summary information about the referenced patient, prescriber and medication. Some resources (e.g. List, Composition) may provide specific rules about what content must (or must not) be included in the resource narrative. Consideration should be given to the fact that referenced resources may be updated without updating referencing resources, so the proportion of content of a referenced resource included in a referencing resource should be limited. Systems MAY choose how narrative is generated, including how much de-referencing to perform, but SHALL NOT assume that the resource is rendered in any particular context when generating narrative, since resources will be used in multiple contexts.

Resources SHOULD always contain narrative to support human-consumption as a fallback. Structured data SHOULD NOT generally contain information of importance to human readers that is omitted from the narrative. Creators of FHIR resources SHOULD NOT assume that systems will render (or that humans will see) data that is not in the narrative. However, in strictly managed trading systems where all systems share a common data model and additional text is unnecessary or may be a clinical safety risk, the narrative may be omitted. Implementers should consider carefully before doing this, as it will mean that these resources can only be understood in the limited trading environment. Closed trading partner environments are liable to open up during the lifetime of the resources they define. Also, many workflow steps involving finding and aggregating resources are much more difficult or tedious if the resources involved do not have their own text.

Note that [contained](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#contained) Resources SHALL NOT have a narrative of their own.

The narrative is an XHTML fragment with a flag to indicate its relationship to the data:

The contents of the *div* element are an XHTML fragment that SHALL contain only the basic HTML formatting elements described in Chapters 7-11 (except Section 4 of Chapter 9) and 15 of the HTML 4.0 standard, *<a>* elements (either *name* or *href*), images, and internally contained style attributes. The XHTML content SHALL NOT contain a *<head>* element, a *<body>* element, external stylesheet references, deprecated elements, scripts, forms, base/link/xlink, frames, iframes, objects or event related attributes (e.g. *onClick*). This is to ensure that the content of the narrative is contained within the resource and that there is no active content that would introduce [security issues](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#narrative), and potentially safety issues, with regard to extracting text from the XHTML.

The div element SHALL have some non-whitespace content (text or an image).

<narrative>

<div xmlns="http://www.w3.org/1999/xhtml">This is a simple

example with only plain text</div>

</narrative>

<narrative>

<div xmlns="http://www.w3.org/1999/xhtml">

<p>

This is an <i>example</i> with some <b>xhtml</b> formatting.

</p>

</div>

</narrative>

The inner portion of the *div* content is often used for the *innerHTML* property in a browser. In order to simplify this kind of processing, when the narrative is represented in JSON, it SHALL be encoded so that the characters between the first ‘*>*’ and the last ‘*<*’ delimiters is the content of the *<div>* element. e.g.

"div": "<div>text</div>"

is legal, but this is not:

"div": "<?xml ...><div>text</div>"

Note that the XHTML is contained in general XML and there is no support for HTML entities like *&nbsp;* or *&copy;* etc. Unicode characters SHALL be used instead. Unicode *&#160;* substitutes for *&nbsp;*.

The narrative content SHOULD be in the [language of the resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource-definitions.html#Resource.language), but there is no reason to expect that HTML type tooling would understand the resource [language](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#content) element. For this reason, a *lang* attribute on the *<div>* SHOULD also be used (also see [the note in the HTML 5 specification about use of language](http://www.w3.org/html/wg/drafts/html/master/dom.html#the-lang-and-xml:lang-attributes)).

### Image References

Image source data (the *src* attribute) may refer to an image found in the resource (as a contained [Media](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\media.html) or [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#binary) resource) by its *id*:

<Patient xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

<p>... <img src="#pic1"/>. ....</p>

</div>

</text>

<contained>

<Binary id="pic1" contentType="image/gif">MEKH....SD/Z</Binary>

</contained>

References between the narrative and the resource data (in either direction) are mediated by the XML *id/idref* attributes. In JSON, the property "*id*" is used, which is equivalent to the XML attribute "*id*".

The "*id*" attribute SHALL have a unique value within the resource with regard to any other id attributes: the uniqueness and resolution scope of these id references is within the resource that contains them. Contained resources are included in the id uniqueness scope of the resource that contains them.

If multiple resources are combined into a single combined document, such as a *[Bundle](file:///C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\bundle.html)*, duplicate values of the *id* attribute may occur between resources. This SHALL be managed by applications reading the resources.

Since images that are not contained in the resource cannot be guaranteed to be available when the resource is presented to a user, the source for any images that are an essential part of the narrative SHOULD always be embedded as a [data: url](https://tools.ietf.org/html/rfc2397), in an attachment or a contained resource.

### Styling the XHTML

The XHTML fragment in the narrative may be styled using cascading stylesheets, using either external or internal styles. External styles are applied using the *class* and *id* attributes on the XHTML elements, and internal styles are applied using a *style* attribute on the XHTML elements directly.

In order to minimise manageability and security issues, authoring systems do not specify the CSS stylesheet to use directly. Instead, the application that displays the resource provides the stylesheets. This means that the rendering system chooses what styles can be used, but the authoring system must use them in advance. Authoring systems can use these classes, which SHALL be supported by all rendering systems:

|  |  |  |
| --- | --- | --- |
| bold | Bold | { font-weight: bold } |
| italics | Italics Text | { font-style: italic } |
| underline | Underlined Text | { text-decoration: underline } |
| strikethrough | Strikethrough Text | { text-decoration: line-through } |
| left | Left Aligned | { text-align : left } |
| right | Right Aligned | { text-align : right } |
| center | Center Aligned | { text-align : center } |
| justify | Justified | { text-align : justify } |
| border-left | Border on the left | { border-left: 1px solid grey } |
| border-right | Border on the right | { border-right: 1px solid grey } |
| border-top | Border on the top | { border-top: 1px solid grey } |
| border-bottom | Border on the bottom | { border-bottom: 1px solid grey } |
| arabic | List is ordered using Arabic numerals: 1, 2, 3 | { list-style-type: decimal } |
| little-roman | List is ordered using little Roman numerals: i, ii, iii | { list-style-type: lower-roman } |
| big-roman | List is ordered using big Roman numerals: I, II, III | { list-style-type: upper-roman } |
| little-alpha | List is ordered using little alpha characters: a, b, c | { list-style-type: lower-alpha } |
| big-alpha | List is ordered using big alpha characters: A, B, C | { list-style-type: upper-alpha } |
| disc | List bullets are simple solid discs | { list-style-type: disc } |
| circle | List bullets are hollow discs | { list-style-type : circle } |
| square | List bullets are solid squares | { list-style-type: square } |
| unlist | List with no bullets | { list-style-type: none } |

Note: for testing purposes, there is an [example resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\basic-example-narrative.xml.html) that includes all these styles. It's also available [as XHTML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative-example.html) and a [standard stylesheet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-runtime.css) that includes all these styles.

Authoring systems may refer to additional classes, but cannot rely on the fact that they will be supported. If the additional classes are critical for safe rendering, trading partner agreements will be required.

Authoring systems may also use internal styles using the *style* attribute. This has the advantage of not depending on external interpretation, but also has the side effect of making content more difficult to manage when rendering, so applications should use this approach with care. Authoring systems may fix the following styling aspects of the content:

* bold, italic, underline, strikethrough
* font color, family and size
* background color, text alignment
* whitespace interpretation
* ordered list number format (since it may be referred to in text)

These style properties are specified in-line using the *style* attribute. Rendering systems SHOULD respect any of these rendering styles when they are specified in the *style* attribute, though appropriate interpretation is allowed (e.g. a low-contrast display for dark room contexts or a high-contrast display for the visually impaired may adjust colours accordingly).

Note that rendering systems are allowed to ignore or override any of the internal or external styles described above, but SHOULD be careful to ensure that this is only done in the context of well maintained trading partner agreements, as altering the presentation of the text may create clinical safety issues.

Authors MAY specify additional styles and style properties as specified in the CSS specification, but these are extensions to this specification and renderers are not required to heed them. It SHOULD be safe to view the narrative without these additional styling features available.

Note that there are additional rules around styling for [documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html#css) presentation.

### Clinical Safety Concerns

Health care records are often associated with legislative and business requirements for very long retention times (up to a century), and extreme risk aversion with regards to inconsistent display across a variety of devices. Although the narrative is allowed to use the standard XHTML and CSS features as described above, implementations are encouraged to show restraint when using the features available. Even where trading partner arrangements limit the current requirements made on a system, experience shows that these trading arrangements may gradually broaden over time.

In particular:

* complex layered layouts requiring careful testing of the match between the XHTML *div* and *span* elements and styles, and those that include nested tables (possibly with images) as well make rendering consistency difficult, and implementations SHOULD avoid these
* The use of styles e.g. bolding, italics and colour; SHOULD not be utilized as the sole way to convey meaning or semantics, but should be used in conjunction with other FHIR resources to ensure consistent, long term interoperability.

# ncimeta.html

## Using the NCI Metathesaurus with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | NCI Metathesaurus [the NCI Center for Biomedical Informatics and Information Technology (CBIIT)](http://cbiit.nci.nih.gov) |
| System | The URI <http://ncimeta.nci.nih.gov> identifies the NCI Metathesaurus |
| Version | There is no version or versioning associated with the NCI metathesaurus |
| Code | The Concept Unique Identifier (CUI) is used for the code value for a Metathesaurus concept |
| Display | The name should be used as the display for English usage (e.g. *"Aerosol Dose Form"* for CUI C1112870) |
| Filter Properties | None are described yet |

### Version Issues

There are no staged releases of the NCI metathesaurus, so there is no versioning policy.

### Copyright/License Issues

The NCI metathesaurus is in the public domain, so there are not copyright notices needed in value sets that refer to NCI metathesaurus concepts, and there are no licensing requirements to use concepts in instances or systems.

### MCI Metathesaurus MySQL Database

Like [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html) the RRF files that are the distributed source of the NCI Metathesaurus can be used to populate a MySQL database that contains the data. This page provides SQL statements that describe how to implement the features of the NCI Metathesaurus correctly against this database. These are provided for implementer convenience, and do not imply that any particular approach must be used in implementations. (Note: for consistency, the RxNorm table and column names are used, and the CUIs are 1 character longer, so the scripts must be updated).

For example, the correct display name for a CUI is 'select STR from rxnconso where RXCUI = :code and SAB = 'RXNORM' and TTY <> 'SY'.

### NCI metathesaurus Filter Properties

This section documents the property filters that can be used with the RxNorm code system in value set composition statements.

The base SQL statement for returning a list of CUIS that conform to these filters is:

select RXCUI from RXNCONSO where SAB = 'RXNORM' and TTY <> 'SY'

#### Semantic Type

|  |  |
| --- | --- |
| Description | Allows to choose a set of CUIs based on their Semantic Type |
| Property Name | STY |
| Operations Allowed | = / in |
| Values Allowed | [column:]value |
| Comments | If not column is specified, the default column is TUI |
| SQL | and RXCUI in (select RXCUI from RXNSTY where [:column] = :value) |

#### Source

|  |  |
| --- | --- |
| Description | Allows for selection of the set of concepts that have mappings to a particular rxnorm source |
| Property Name | SAB |
| Operations Allowed | = / in |
| Values Allowed | Values from the SAB table (e.g. select RSAB from RXNsab) |
| SQL | and RXCUI in (select RXCUI from RXNconso where SAB = :value) |

#### Term Type

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on its designated type |
| Property Name | TTY |
| Operations Allowed | = / in |
| Values Allowed | TTY values from the RxNorm Concept table (e.g. select distinct TTY from rxnconso) |
| SQL | and TTY = :value |

#### Relationship

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on its relationships |
| Property Name | [REL] |
| Operations Allowed | = / in |
| Values Allowed | CUI:[RXCUI] or AUI:[RXAUI] must be a valid CUI or AUI. Note that a CUI does not need to have a SAB=RXNORM entry to be used here |
| Comments | [REL] (:rel) is one of AQ, CHD, PAR, QB, RB, RN, RO, RQ, SIB or SY |
| SQL | for CUI:  and (RXCUI in (select RXCUI from rxnconso where RXCUI in (select RXCUI1 from rxnrel where REL = :rel and RXCUI2 = :value))  for AUI:  and (RXCUI in (select RXCUI from rxnconso where RXAUI in (select RXAUI1 from rxnrel where REL = :rel and RXAUI2 = :value)) |

#### Relationship Type

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on the type of its relationships |
| Property Name | [RELA] |
| Operations Allowed | = / in |
| Values Allowed | CUI:[RXCUI] or AUI:[RXAUI] must be a valid CUI or AUI. Note that a CUI does not need to have a SAB=RXNORM entry to be used here |
| Comments | [RELA] (:rela) is one of the relationship types listed in the NCI file "Relationships\_Help\_Page.txt" - the current list (nearly 1000 types) is at the end of the page |
| SQL | for CUI:  and (RXCUI in (select RXCUI from rxnconso where RXCUI in (select RXCUI1 from rxnrel where RELA = :rel and RXCUI2 = :value))  for AUI:  and (RXCUI in (select RXCUI from rxnconso where RXAUI in (select RXAUI1 from rxnrel where RELA = :rel and RXAUI2 = :value)) |

### Implicit Value Sets

This section needs investigation

### Current NCI Metathesaurus relationship types

* 3\_UTR\_of
* 5\_UTR\_of
* Abnormal\_Cell\_Affected\_By\_Chemical\_Or\_Drug
* Abnormality\_Associated\_With\_Allele
* Abstract\_of
* access\_device\_used\_by
* access\_of
* action\_of
* active\_ingredient\_of
* active\_metabolites\_of
* Activity\_Of\_Allele
* adheres\_to
* adjacent\_to
* afferent\_to
* agent\_in
* alias\_of
* Allele\_Absent\_From\_Wild-type\_Chromosomal\_Location
* Allele\_Has\_Abnormality
* Allele\_Has\_Activity
* Allele\_In\_Chromosomal\_Location
* Allele\_of
* Allele\_Plays\_Altered\_Role\_In\_Process
* Allele\_Plays\_Role\_In\_Metabolism\_Of\_Chemical\_Or\_Drug
* allelic\_variant\_of
* Amino\_Acid\_Variant\_of
* analyzed\_by
* analyzes
* Anatomic\_Structure\_Has\_Location
* Anatomic\_Structure\_Is\_Physical\_Part\_Of
* anatomical\_site
* Anatomy\_Originated\_From\_Biological\_Process
* Aneuploidy\_Addition\_of
* Aneuploidy\_Deletion\_of
* anterior\_to
* application\_of
* Arm\_Location\_of
* Arm\_of
* arterial\_supply\_of
* articulates\_with
* associated\_disease
* associated\_finding\_of
* associated\_genetic\_condition
* associated\_morphology\_of
* associated\_procedure\_of
* associated\_with
* Associated\_With\_Malfunction\_Of\_Gene\_Product
* attaches\_to
* attributed\_constitutional\_part\_of
* attributed\_continuous\_with
* attributed\_part\_of
* attributed\_regional\_part\_of
* Author\_of
* Band\_Location\_of
* Band\_of
* bearer\_of
* Biological\_Process\_Has\_Associated\_Location
* Biological\_Process\_Has\_Initiator\_Chemical\_Or\_Drug
* Biological\_Process\_Has\_Initiator\_Process
* Biological\_Process\_Has\_Result\_Anatomy
* Biological\_Process\_Has\_Result\_Biological\_Process
* Biological\_Process\_Has\_Result\_Chemical\_Or\_Drug
* Biological\_Process\_Involves\_Chemical\_Or\_Drug
* Biological\_Process\_Involves\_Gene\_Product
* Biological\_Process\_Is\_Part\_Of\_Process
* Biological\_Process\_Results\_From\_Biological\_Process
* Biomarker\_Type\_Includes\_Gene
* Biomarker\_Type\_Includes\_Gene\_Product
* blood\_supply\_of
* bounded\_by
* bounds
* branch\_of
* branch\_part\_of
* causative\_agent\_of
* cause\_of
* cell\_connecting\_part\_of
* cell\_shape\_of
* cell\_surface\_specialization\_of
* Cell\_Type\_Is\_Associated\_With\_EO\_Disease
* Cell\_Type\_Or\_Tissue\_Affected\_By\_Chemical\_Or\_Drug
* Centromere\_of
* CH3\_Status\_of
* Chemical\_Or\_Drug\_Affects\_Abnormal\_Cell
* Chemical\_Or\_Drug\_Affects\_Cell\_Type\_Or\_Tissue
* Chemical\_Or\_Drug\_Affects\_Gene\_Product
* Chemical\_Or\_Drug\_Has\_Mechanism\_Of\_Action
* Chemical\_Or\_Drug\_Has\_Physiologic\_Effect
* Chemical\_Or\_Drug\_Initiates\_Biological\_Process
* Chemical\_Or\_Drug\_Is\_Metabolized\_By\_Enzyme
* Chemical\_Or\_Drug\_Is\_Product\_Of\_Biological\_Process
* Chemical\_Or\_Drug\_Metabolism\_Is\_Associated\_With\_Allele
* Chemical\_Or\_Drug\_Plays\_Role\_In\_Biological\_Process
* chemical\_structure\_of
* Chemotherapy\_Regimen\_Has\_Component
* Chromosomal\_Location\_of
* Chromosomal\_Location\_Of\_Allele
* Chromosomal\_Location\_of\_Wild-type\_Gene
* Chromosomal\_Structural\_Variant
* Chromosome\_Involved\_In\_Cytogenetic\_Abnormality
* Chromosome\_Mapped\_To\_Disease
* class\_code\_classified\_by
* classified\_as
* classifies
* classifies\_class\_code
* clinical\_course\_of
* common\_name\_of
* Completely\_Excised\_Anatomy\_Has\_Procedure
* Completely\_Excised\_Anatomy\_May\_Have\_Procedure
* Complex\_Has\_Physical\_Part
* component\_of
* Concept\_In\_Subset
* conceptual\_part\_of
* conjugate\_component\_of
* consider
* consider\_from
* consists\_of
* Constituent\_Amino\_Acid\_of
* Constituent\_Element\_of
* Constituent\_Protein\_of
* Constituent\_Variant\_of
* constitutes
* constitutional\_part\_of
* contained\_in
* contains
* context\_binding\_of
* continuation\_branch\_of
* continuous\_with
* continuous\_with\_distally
* continuous\_with\_proximally
* contraindicated\_with\_disease
* contraindicating\_class\_of
* contraindicating\_mechanism\_of\_action\_of
* contraindicating\_physiologic\_effect\_of
* Cytogenetic\_Abnormality\_Involves\_Chromosome
* Data\_Element\_Of
* definitional\_manifestation\_of
* degree\_of
* Deleted\_Region\_End\_Band
* Deleted\_Region\_Start\_Band
* denoted\_by
* denotes
* dependent\_of
* derivatized\_to
* derives\_from
* determines\_parameter\_for
* determines\_property
* develops\_from
* device\_used\_by
* diagnosed\_by
* diagnoses
* direct\_device\_of
* direct\_morphology\_of
* direct\_procedure\_site\_of
* direct\_substance\_of
* Disease\_Excludes\_Abnormal\_Cell
* Disease\_Excludes\_Cytogenetic\_Abnormality
* Disease\_Excludes\_Finding
* Disease\_Excludes\_Molecular\_Abnormality
* Disease\_Excludes\_Normal\_Cell\_Origin
* Disease\_Excludes\_Normal\_Tissue\_Origin
* Disease\_Excludes\_Primary\_Anatomic\_Site
* Disease\_Has\_Abnormal\_Cell
* Disease\_Has\_Accepted\_Treatment\_With\_Regimen
* Disease\_Has\_Associated\_Anatomic\_Site
* Disease\_Has\_Associated\_Disease
* Disease\_Has\_Associated\_Gene
* Disease\_Has\_Cytogenetic\_Abnormality
* Disease\_Has\_Finding
* Disease\_Has\_Metastatic\_Anatomic\_Site
* Disease\_Has\_Molecular\_Abnormality
* Disease\_Has\_Normal\_Cell\_Origin
* Disease\_Has\_Normal\_Tissue\_Origin
* Disease\_Has\_Primary\_Anatomic\_Site
* Disease\_Is\_Grade
* Disease\_Is\_Marked\_By\_Gene
* Disease\_Is\_Stage
* Disease\_Mapped\_To\_Chromosome
* Disease\_Mapped\_To\_Gene
* Disease\_May\_Have\_Abnormal\_Cell
* Disease\_May\_Have\_Associated\_Disease
* Disease\_May\_Have\_Cytogenetic\_Abnormality
* Disease\_May\_Have\_Finding
* Disease\_May\_Have\_Molecular\_Abnormality
* Disease\_May\_Have\_Normal\_Cell\_Origin
* Disease\_Pathogenesis\_Involves\_Gene
* disease\_with\_contraindication
* distal\_to
* DOI\_of
* dose\_form\_of
* doseformgroup\_of
* drains\_into
* drug\_contraindicated\_for
* due\_to
* Duplicated\_Region\_End\_Band
* Duplicated\_Region\_Start\_Band
* effect\_may\_be\_inhibited\_by
* Effect\_of
* efferent\_to
* encapsulated\_component\_of
* Encoded\_by
* Encodes
* Endogenous\_Product\_Related\_To
* energy\_used\_by
* entrapment\_site\_of
* entrapped\_component\_of
* entry\_version\_of
* Enzyme\_Metabolizes\_Chemical\_Or\_Drug
* EO\_Anatomy\_Is\_Associated\_With\_EO\_Disease
* EO\_Disease\_Has\_Associated\_Cell\_Type
* EO\_Disease\_Has\_Associated\_EO\_Anatomy
* EO\_Disease\_Has\_Property\_Or\_Attribute
* EO\_Disease\_Maps\_To\_Human\_Disease
* epithelial\_cell\_shape\_of
* evaluation\_of
* Excised\_Anatomy\_Has\_Procedure
* Excised\_Anatomy\_May\_Have\_Procedure
* exhibited\_by
* exhibits
* Exon\_of
* expanded\_form\_of
* external\_to
* fascicular\_architecture\_of
* Feature\_of
* finding\_context\_of
* finding\_informer\_of
* finding\_method\_of
* finding\_site\_of
* focus\_of
* form\_of
* function\_of
* Gene\_Associated\_With\_Disease
* Gene\_Encodes\_Gene\_Product
* Gene\_Found\_In\_Organism
* Gene\_Has\_Abnormality
* Gene\_Has\_Physical\_Location
* Gene\_In\_Chromosomal\_Location
* Gene\_Involved\_In\_Molecular\_Abnormality
* Gene\_Involved\_In\_Pathogenesis\_Of\_Disease
* Gene\_Is\_Biomarker\_Of
* Gene\_Is\_Biomarker\_Type
* Gene\_Is\_Element\_In\_Pathway
* Gene\_Location\_of
* Gene\_Mapped\_To\_Disease
* Gene\_Mutant\_Encodes\_Gene\_Product\_Sequence\_Variation
* Gene\_of
* Gene\_Plays\_Role\_In\_Process
* Gene\_Product\_Affected\_By\_Chemical\_Or\_Drug
* Gene\_Product\_Encoded\_By\_Gene
* Gene\_Product\_Expressed\_In\_Tissue
* Gene\_Product\_Has\_Abnormality
* Gene\_Product\_Has\_Associated\_Anatomy
* Gene\_Product\_Has\_Biochemical\_Function
* Gene\_Product\_Has\_Chemical\_Classification
* Gene\_Product\_Has\_Organism\_Source
* Gene\_Product\_Has\_Structural\_Domain\_Or\_Motif
* Gene\_Product\_Is\_Biomarker\_Of
* Gene\_Product\_Is\_Biomarker\_Type
* Gene\_Product\_Is\_Element\_In\_Pathway
* Gene\_Product\_Is\_Physical\_Part\_Of
* Gene\_Product\_Malfunction\_Associated\_With\_Disease
* Gene\_Product\_Plays\_Role\_In\_Biological\_Process
* Gene\_Product\_Sequence\_Variation\_Encoded\_By\_Gene\_Mutant
* Genomic\_Mutation\_Of
* germ\_origin\_of
* gives\_rise\_to
* Has\_3\_UTR
* Has\_5\_UTR
* has\_Abstract
* has\_access
* has\_action
* has\_active\_ingredient
* has\_active\_metabolites
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* has\_affiliation
* has\_agent
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* has\_allelic\_variant
* Has\_Amino\_Acid\_Variant
* Has\_Aneuploidy\_Addition
* Has\_Aneuploidy\_Deletion
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* Has\_Arm\_Location
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* has\_associated\_procedure
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* has\_attributed\_regional\_part
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* Has\_Band
* Has\_Band\_Location
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* Has\_Chromosomal\_Location
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* has\_clinical\_treatment
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* has\_conceptual\_part
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* Has\_Constituent\_Element
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* Has\_Constituent\_Variant
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* has\_contraindicating\_physiologic\_effect
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* has\_disease\_staging
* has\_disease\_state
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* has\_donor
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* has\_endpoint\_of\_measurement
* has\_entrapment\_site
* has\_entrapped\_component\_part
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* Has\_Exon
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* has\_experiment\_design\_type
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* Has\_Gene\_Location
* Has\_Gene\_Product\_Element
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* has\_indirect\_morphology
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* has\_insertion
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* has\_interpretation
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* has\_measure
* has\_measurement
* has\_measurement\_method
* has\_measurement\_type
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* has\_method
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* has\_muscle\_insertion
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* has\_owning\_subsection
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* has\_participant
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* has\_physiologic\_effect
* has\_precise\_ingredient
* has\_primary\_segmental\_supply
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* has\_temporal\_context
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* Has\_Transcript
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* has\_tributary
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* has\_unit\_of\_measure
* has\_units
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* has\_version
* Human\_Disease\_Maps\_To\_EO\_Disease
* Human\_Sex\_Determinant
* icd\_dagger
* identification\_type\_of
* Imaged\_Anatomy\_Has\_Procedure
* included\_in
* includes
* indicator\_of
* indirect\_device\_of
* indirect\_morphology\_of
* indirect\_procedure\_site\_of
* induced\_by
* induces
* inferior\_to
* ingredient\_of
* ingredients\_of
* inherence\_for
* inherent\_3d\_shape\_of
* inheres\_in
* inheritance\_type\_of
* innervates
* insertion\_of
* instrument\_used\_by
* intent\_of
* internal\_to
* interpretation\_of
* interprets
* Intron\_of
* INV\_Chromosomal\_Structural\_Variant
* INV\_Deleted\_Region\_End\_Band
* INV\_Deleted\_Region\_Start\_Band
* INV\_Duplicated\_Region\_End\_Band
* INV\_Duplicated\_Region\_Start\_Band
* INV\_Human\_Sex\_Determinant
* INV\_Inverted\_Region\_End\_Band
* INV\_Inverted\_Region\_End\_Exon
* INV\_Inverted\_Region\_End\_Gene
* INV\_Inverted\_Region\_End\_UTR
* INV\_Inverted\_Region\_Start\_Band
* INV\_Inverted\_Region\_Start\_Exon
* INV\_Inverted\_Region\_Start\_Gene
* INV\_Inverted\_Region\_Start\_Intron
* INV\_Involves
* INV\_Isochromosome\_Origin
* INV\_Karyotype\_Class
* INV\_Source\_Band
* INV\_Source\_Exon
* INV\_Source\_Gene
* INV\_Source\_Intron
* INV\_Target\_Band
* INV\_Target\_Exon
* INV\_Target\_Gene
* INV\_Target\_Intron
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* inverse\_has\_affiliation
* inverse\_has\_atmospheric\_component
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* inverse\_has\_biomaterial\_characteristics
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* inverse\_has\_clinical\_treatment
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* inverse\_has\_test\_result
* inverse\_has\_test\_type
* inverse\_has\_treatment
* inverse\_has\_type
* inverse\_has\_units
* inverse\_has\_URI
* inverse\_isa
* inverse\_was\_tested\_for
* Inverted\_Region\_End\_Band
* Inverted\_Region\_End\_Exon
* Inverted\_Region\_End\_Gene
* Inverted\_Region\_End\_UTR
* Inverted\_Region\_Start\_Band
* Inverted\_Region\_Start\_Exon
* Inverted\_Region\_Start\_Gene
* Inverted\_Region\_Start\_Intron
* Involves
* Is\_Abnormal\_Cell\_Of\_Disease
* Is\_Abnormality\_Of\_Gene
* Is\_Abnormality\_Of\_Gene\_Product
* is\_anatomical\_site\_of
* Is\_Associated\_Anatomic\_Site\_Of
* Is\_Associated\_Anatomy\_Of\_Gene\_Product
* Is\_Associated\_Disease\_Of
* Is\_Biochemical\_Function\_Of\_Gene\_Product
* is\_borne\_by
* Is\_Chemical\_Classification\_Of\_Gene\_Product
* Is\_Chromosomal\_Location\_Of\_Gene
* Is\_Component\_Of\_Chemotherapy\_Regimen
* Is\_Cytogenetic\_Abnormality\_Of\_Disease
* is\_datum\_of
* Is\_Finding\_Of\_Disease
* Is\_Grade\_Of\_Disease
* is\_integral\_part\_of
* is\_interpreted\_by
* Is\_Location\_Of
* Is\_Location\_Of\_Anatomic\_Structure
* Is\_Location\_Of\_Biological\_Process
* Is\_Marked\_By\_Gene\_Product
* is\_measurement\_endpoint\_of
* Is\_Mechanism\_Of\_Action\_Of\_Chemical\_Or\_Drug
* Is\_Metastatic\_Anatomic\_Site\_Of\_Disease
* Is\_Molecular\_Abnormality\_Of\_Disease
* Is\_Normal\_Cell\_Origin\_Of\_Disease
* Is\_Normal\_Tissue\_Origin\_Of\_Disease
* Is\_Not\_Abnormal\_Cell\_Of\_Disease
* Is\_Not\_Cytogenetic\_Abnormality\_Of\_Disease
* Is\_Not\_Finding\_Of\_Disease
* Is\_Not\_Molecular\_Abnormality\_Of\_Disease
* Is\_Not\_Normal\_Cell\_Origin\_Of\_Disease
* Is\_Not\_Normal\_Tissue\_Origin\_Of\_Disease
* Is\_Not\_Primary\_Anatomic\_Site\_Of\_Disease
* Is\_Organism\_Source\_Of\_Gene\_Product
* Is\_Physical\_Location\_Of\_Gene
* Is\_Physiologic\_Effect\_Of\_Chemical\_Or\_Drug
* Is\_Primary\_Anatomic\_Site\_Of\_Disease
* Is\_Property\_Or\_Attribute\_Of\_EO\_Disease
* Is\_Qualified\_By
* is\_realized\_in
* Is\_Related\_To\_Endogenous\_Product
* Is\_Stage\_Of\_Disease
* Is\_Structural\_Domain\_Or\_Motif\_Of\_Gene\_Product
* Is\_Target\_Of\_Agent
* is\_temperature\_of
* is\_time\_period\_of
* isa
* Isochromosome\_Origin
* Journal\_Name\_of
* Karyotype\_Class
* Kind\_Is\_Domain\_Of
* Kind\_Is\_Range\_Of
* larger\_than
* laterality\_of
* location\_of
* lymphatic\_drainage\_of
* manifestation\_of
* mapped\_from
* mapped\_to
* mapping\_qualifier\_of
* Maternal\_Uniparental\_Disomy\_of
* May\_Be\_Abnormal\_Cell\_Of\_Disease
* May\_Be\_Associated\_Disease\_Of\_Disease
* may\_be\_caused\_by
* May\_Be\_Cytogenetic\_Abnormality\_Of\_Disease
* may\_be\_diagnosed\_by
* May\_Be\_Finding\_Of\_Disease
* May\_Be\_Molecular\_Abnormality\_Of\_Disease
* May\_Be\_Normal\_Cell\_Origin\_Of\_Disease
* may\_be\_prevented\_by
* may\_be\_qualified\_by
* may\_be\_treated\_by
* may\_cause
* may\_diagnose
* may\_inhibit\_effect\_of
* may\_prevent
* may\_qualify
* may\_treat
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* measurement\_method\_of
* measurement\_of
* measures
* mechanism\_of\_action\_of
* member\_of
* metabolic\_site\_of
* method\_of
* modality\_is\_related\_to
* Mode\_of\_Inheritance
* Molecular\_Abnormality\_Involves\_Gene
* mth\_british\_form\_of
* mth\_expanded\_form\_of
* mth\_has\_british\_form
* mth\_has\_expanded\_form
* mth\_has\_plain\_text\_form
* mth\_has\_xml\_form
* mth\_plain\_text\_form\_of
* mth\_xml\_form\_of
* muscle\_attachment\_of
* muscle\_insertion\_of
* muscle\_origin\_of
* Negative\_Protein\_Expression
* Negatively\_Expressed\_By
* negatively\_regulated\_by
* negatively\_regulates
* nerve\_supply\_of
* Nucleotide\_Repeat\_of
* Nucleotide\_Variant\_of
* occurs\_after
* occurs\_before
* occurs\_in
* Organism\_Has\_Gene
* orientation\_of
* origin\_of
* owning\_affiliate\_of
* owning\_section\_of
* owning\_subsection\_of
* parameter\_determined\_from
* Parent\_Is\_CDRH
* Parent\_Is\_NICHD
* part\_component\_of
* part\_of
* Partially\_Excised\_Anatomy\_Has\_Procedure
* Partially\_Excised\_Anatomy\_May\_Have\_Procedure
* participates\_in
* Paternal\_Uniparental\_Disomy\_of
* pathological\_process\_of
* Pathway\_Has\_Gene\_Element
* permuted\_term\_of
* pharmacokinetics\_of
* physical\_state\_of
* physiologic\_effect\_of
* Positive\_Protein\_Expression
* Positively\_Expressed\_By
* positively\_regulated\_by
* positively\_regulates
* posterior\_to
* precise\_ingredient\_of
* primary\_segmental\_supply\_of
* print\_name\_of
* priority\_of
* procedure\_context\_of
* procedure\_device\_of
* Procedure\_Has\_Completely\_Excised\_Anatomy
* Procedure\_Has\_Excised\_Anatomy
* Procedure\_Has\_Imaged\_Anatomy
* Procedure\_Has\_Partially\_Excised\_Anatomy
* Procedure\_Has\_Target\_Anatomy
* Procedure\_May\_Have\_Completely\_Excised\_Anatomy
* Procedure\_May\_Have\_Excised\_Anatomy
* Procedure\_May\_Have\_Partially\_Excised\_Anatomy
* procedure\_morphology\_of
* procedure\_site\_of
* Process\_Altered\_By\_Allele
* Process\_Includes\_Biological\_Process
* Process\_Initiates\_Biological\_Process
* Process\_Involves\_Gene
* product\_component\_of
* projects\_from
* projects\_to
* projects\_towards
* property\_determined\_from
* property\_of
* proximal\_to
* Publication\_Year\_of
* PubMedID\_of
* Qualifier\_Applies\_To
* quality\_of
* quantified\_form\_of
* reagent\_used\_in
* realizes
* receives\_attachment
* receives\_drainage\_from
* receives\_input\_from
* receives\_projection\_from
* recipient\_category\_of
* reformulated\_to
* reformulation\_of
* Regimen\_Has\_Accepted\_Use\_For\_Disease
* regional\_part\_of
* regulated\_by
* regulates
* related\_modality
* related\_to
* replaced\_by
* replaces
* responsive\_to\_stimulus
* result\_of
* result\_of\_regulation
* results\_in
* revision\_status\_of
* Role\_Has\_Domain
* Role\_Has\_Parent
* Role\_Has\_Range
* Role\_Is\_Parent\_Of
* role\_of
* route\_of\_administration\_of
* RT\_Product\_of
* scale\_of
* scale\_type\_of
* secondary\_segmental\_supply\_of
* see
* see\_from
* Segment\_of
* segmental\_composition\_of
* segmental\_supply\_of
* sends\_output\_to
* severity\_of
* shape\_of
* sib\_in\_branch\_of
* sib\_in\_isa
* sib\_in\_part\_of
* sib\_in\_tributary\_of
* site\_of\_metabolism
* smaller\_than
* sort\_version\_of
* Source\_Band
* Source\_Exon
* Source\_Gene
* Source\_Intron
* specifies\_value
* specimen\_of
* specimen\_procedure\_of
* specimen\_source\_identity\_of
* specimen\_source\_morphology\_of
* specimen\_source\_topography\_of
* specimen\_substance\_of
* stimulus\_causes\_response
* subject\_relationship\_context\_of
* Subset\_Includes\_Concept
* Subset\_of
* substance\_used\_by
* Subsumed\_By
* Subsumes
* superior\_to
* supported\_concept\_property\_in
* supported\_concept\_relationship\_in
* surgical\_approach\_of
* surrounded\_by
* surrounds
* systemic\_part\_of
* Target\_Anatomy\_Has\_Procedure
* Target\_Band
* Target\_Exon
* Target\_Gene
* Target\_Intron
* technique\_used\_for
* Telomere\_of
* temporal\_context\_of
* therapeutic\_class\_of
* Tissue\_Is\_Expression\_Site\_Of\_Gene\_Product
* tradename\_of
* Transcript\_of
* treated\_by
* treats
* tributary\_of
* unit\_of
* unit\_of\_measurement\_of
* use
* used\_by
* used\_for
* uses
* uses\_access\_device
* uses\_device
* uses\_energy
* uses\_instrument
* uses\_reagent
* uses\_substance
* uses\_technique
* value\_specified\_at
* venous\_drainage\_of
* version\_of
* was\_tested\_for

# ndc.html

## Using NDC and NHRIC Codes with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The National Drug Codes (NDC) and National Health Related Items Code (NHRIC) codes are codes issued by the FDA for tracking drugs and devices. Note that the NHRIC codes are being replaced by the [UDI system](http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/UniqueDeviceIdentification/).

### Summary

|  |  |
| --- | --- |
| Source | [National Drug Code Directory](http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm) and the [NHRIC Labeler Codes](http://www.fda.gov/ForIndustry/DataStandards/StructuredProductLabeling/ucm191017.htm) |
| System | The URI to identify NDC/NHRIC codes is http://hl7.org/fhir/sid/ndc |
| Version | Use YYYMMDD for the date of publication, but see note below |
| Code | The 10 digit NDC code, with "-" included. Note that different NDC codes have different positions for the "-": 1234-5678-90, 12345-6789-0, or 12345-678-90. The "-" must be correct for each NDC code |
| Display | Use the PACKAGEDESCRIPTION column value from the TSV or Excel distribution file |
| Filter Properties | None are described yet |

### Version Issues

The FDA published list of NDC codes for [finished drug products](http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm) is updated daily. Use the format YYYYMMDD to refer to a particular distribution. Note that only valid NDC codes appear in the distribution file, there are other NDC codes that organizations have assigned but not yet reported to FDA, so the full set of NDCs that exists in the marketplace is unknown, and therefore cannot be versioned completely.

### Copyright/License Issues

NDC codes have no copyright acknowledgement needed, nor are there any license terms to adhere to.

### NDF-RT Filter Properties

No need for filters identified yet.

### Implicit Value Sets

No need for implicit value sets identified yet.

# ndfrt.html

## Using NDF-RT (The National Drug File - Reference Terminology) with FHIR

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| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | The National Drug File - Reference Terminology ,prepared by the [Veterans Health Administration](http://www.va.gov/health/) and distributed as part of [UMLS](http://www.nlm.nih.gov/research/umls/) by the [NLM](http://www.nlm.nih.gov/) ([direct link](http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NDFRT/)) |
| System | The URI to identify NDF-RT is not resolved. As a temporary arrangement, the URL "http://hl7.org/fhir/ndfrt" is to be used |
| Version | A version is not needed. Use the date of the UMLS release for the version of NDF-RT if a version is desired |
| Code | The NUI is used for the code value for an NDF-RT concept |
| Display | ?? |
| Filter Properties | None are described yet |

*This URL is temporary while the NDF-RT and FHIR teams discuss the long term arrangements*. Further documentation can be [found in evs](http://evs.nci.nih.gov/ftp1/NDF-RT/NDF-RT%20Documentation.pdf).

### Version Issues

NDF-RT is released as part of UMLS, therefore each successive release has the date of the UMLS release as its version.

### Copyright/License Issues

NDF-RT has no copyright acknowledgement requirement, however users must adhere to the UMLS license.

### NDF-RT Filter Properties

This section documents the property filters that can be used with the SNOMED CT code system in value set composition statements.

#### By Subsumption

|  |  |
| --- | --- |
| Description | Select a set of concepts based on subsumption testing |
| Property Name | concept |
| Operations Allowed | is-a |
| Values Allowed | NUI |
| Comments | Includes all concepts that have a transitive is-a relationship with the concept Id provided in the value as an NUI |

Others yet to be done.

### Implicit Value Sets

Yet to be done.

# newfooter.html

Â© HL7.org 2011+. FHIR DSTU2 (v-) generated on .   
Links: [What's a DSTU?](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\timelines.html) | [Version History](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html) | [Table of Contents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\toc.html) | [Compare to DSTU](http://services.w3.org/htmldiff?doc1=http%3A%2F%2Fhl7.org%2Fimplement%2Fstandards%2Ffhir%2F&doc2=) | | [Propose a change](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemAdd&tracker_id=677)

# newheader.html

# newnavbar.html

[FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\index.html)

# ns.html

## Namespaces defined by FHIR

# ontology.html

## OWL Ontology

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| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page and the RDF forms are particularly prone to change. The page is not part of the current ballot, and so at the most it can be a draft page in DSTU 2. Comments on this and the page content are welcome.

### Why an ontology

### Overview of the ontology

### Using the ontology

# op-example-request.html

## Operation Request Example

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

POST [base]/ValueSet/$expand HTTP/1.1

Content-Type: application/fhir+xml

<!--

This is an example of a operation request for a value set

expansion where the value set is submitted on the fly

-->

<Parameters xmlns="http://hl7.org/fhir">

<parameter>

<name value="filter"/>

<valueString name="abdo"/>

</parameter>

<parameter>

<name value="valueset"/>

<resource>

<ValueSet>

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml"><!-- Snipped for brevity --></div>

</text>

<identifier value="http://hl7.org/fhir/ValueSet/body-site"/>

<name value="SNOMED CT Body Structures"/>

<publisher value="FHIR Project team"/>

<telecom>

<system value="url"/>

<value value="http://hl7.org/fhir"/>

</telecom>

<description value="This value set includes all the &quot;Clinical finding&quot; SNOMED CT codes (i.e. codes

with an is-a relationship with 91723000: Anatomical structure)"/>

<status value="draft"/>

<compose>

<include><!-- all the descendents of clinical finding, not include itself -->

<system value="http://snomed.info/sct"/>

<filter><!-- todo: work this over. what this means is any concepts where they have is-a with 91723000.

how should this be done? -->

<property value="concept"/>

<op value="is-a"/>

<value value="91723000"/>

</filter>

</include>

</compose>

</ValueSet>

</resource>

</parameter>

</Parameters>

# operations.html

## Extended Operations on the RESTful API

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) defines a set of common interactions performed on a repository of typed resources (*read*, *update*, *search*, etc). These interactions follow the RESTful paradigm of managing state by ***C****reate*/***R****ead*/***U****pdate*/***D****elete* actions on a set of identified resources.

While this approach solves many use cases, there is some specific functionality that can be met more efficiently using an RPC-like paradigm, where named operations are performed with inputs and outputs (***E****xecute*). *Operations* are used (a) where the server needs to play an active role in formulating the content of the response rather than merely returning existing information, or (b) where the intended purpose is to cause side effects (modify existing resources) or to create a new resource. This specification describes a lightweight operation framework that seamlessly extends the RESTful API.

Operations have the following general properties:

* Each operation has a name
* Each operation has a list of 'in' and 'out' parameters
* The parameters are either resources, data types, or search parameters
* The operations are subject to the same security constraints as the RESTful API
* The URIs for the operation end points are based on the existing RESTful API address scheme
* The operations may make use of the existing repository of resources in their definitions
* Operations may be performed on a specific resource, a resource type, or a whole system

### Executing an Operation

Most Operations are *POST*s to a FHIR endpoint, where the name of the operation is prefixed by a ”dollar sign” (‘$’) character. For example:

POST http://fhir.someserver.org/fhir/Patient/1/$everything

When an operation is idempotent, and the parameters are all simple ones (as is the case with the example above), it may be invoked using *GET* as well as *POST*.

Operations can be invoked on four types of FHIR endpoints:

* The base FHIR *service* endpoint (e.g. http://fhir.someserver.org/fhir) These are operations that operate on the full scale of the server, for example: “return me all extensions known by this server”
* A Resource *type* (e.g. http://fhir.someserver.org/fhir/Patient) These are operations that operate across all instances of a given type
* A Resource *instance* (e.g. http://fhir.someserver.org/fhir/Patient/1) These operations involve only a single instance of a Resource, as the $everything operation above does
* A specific *version* of a Resource *instance* (http://fhir.someserver.org/fhir/Patient/1/\_history/4) These operations involve only a specific *version* of a single *instance* of a FHIR Resource, and exist only to allow manipulation of profile and tag metadata of past versions

The body of the invocation contains a special infrastructure resource called [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html), which represents a collection of named parameters as <*key*,*value*> pairs, where the value may be any primitive or complex datatype, or even a full Resource. In addition it may include strings that are formatted as the search parameter types.

On completion, the operation returns another Parameters resource, this time containing one or more output parameters. This means that a FHIR operation can take any in parameter(s) and return a set of out parameters as a result. Both the body of the POST and the returned result are always a Resource.

Operations with simple input types and a single Resource output parameter named 'return' can be invoked using a GET directly, with parameters as HTTP URL parameters. In this case, the response is simply the resource that is the return value, with no Parameters resource.

### FHIR defined Operations

This specification defines several operations:

Notes:

* The special operations on the meta element also operate on previous version (/\_history/) - they are the only ones

### Implementation Defined Operations

Implementations are able to define their own Operations in addition to those defined here. Name clashes between Operations defined by different implementers can be resolved by use of the [Conformance Statement](file:///C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\conformance.html).

Also, the definition of these Operations or additional run time Operations does not prevent the use of other kinds of Operations that are not dependent on and/or not integrated with the RESTful API, as long as their addressing scheme does not clash with the scheme defined here.

### Defining an Operation

Each Operation is defined by:

* A context for the Operation - System, Resource *type*, or Resource *instance*
* A name for the Operation
* A list of parameters along with their definitions

For each parameter, the following information is needed:

* Name: the name of the Operation. For implementer convenience, the name should be a valid token (see below)
* Use: In | Out | Both
* Type: a data type or a Resource type
* Profile: a Profile that applies additional restrictions about the Resource
* Documentation: a description of its use

There is a special parameter type called "Tuple" which is a parameter type that has additional parts. Each part has the same information as a parameter, except for use, which is taken from the parameter it is part of.

The resource [Operation Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) is used to provide a computable definition of the Operation.

### Extending an Operation

Implementations are able to extend an Operation by defining new named parameters. Implementations can publish their own extended definitions using the [Operation Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) resource, and this variant definition can use OperationDefinition.base to refer to the underlying definition.

Note that the FHIR specification will never define any parameter names starting with "x-".

### Executing an Operation Synchronously

Operations are typically executed synchronously: a client sends a request to a server that includes the Operation *in* parameters, and the server replies with the Operation *out* parameters.

The URL for an operation end-point depends on its context:

* System: the url is [base]/$[name]
* Resource *type*: the url is [base]/[type]/$[name]
* Resource *instance*: the url is [base]/[type]/[id]/$[name]

#### Operation Request

An Operation is generally invoked by performing an HTTP POST to the Operation end-point. The submitted content is the special [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) format (the *in* parameters), a list of named parameters. For an example, see [the value set expansion request example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\op-example-request.html).

Note that the same arrangement as the RESTful interface applies in regard to [content types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#mime-type).

If there are no parameters with complex types (including Resources) to the Operation, and the operation is idempotent (see [HTTP specification definition of idempotent](http://www.w3.org/Protocols/rfc2616/rfc2616-sec9.html)), the operation may be invoked by performing an HTTP GET operation, where all of the parameters are appended to the URL in the search portion of the URL (e.g. after the '?' character). Servers SHALL support this method of invocation.

Servers MAY choose to support submission of the parameters using the ‘*multipart/form-data*’ method as well, which can be useful when testing an Operation using HTML forms.

#### Operation Response

If an Operation succeeds, an HTTP Status code of 200 OK is returned. An HTTP status code of 4xx or 5xx indicates an error, and an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) MAY be returned. User agents should note that servers MAY issue redirects, etc. to authenticate the client in response to an Operation request.

In the general case, an Operation response uses the same [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) format whether there is one or there are multiple named *out* parameter(s).

If there is only one *out* parameter, which is a Resource named "return", then the parameter format is not used, and the response is simply the resource itself.

The Resources that are returned by the Operation may be retained and made available in the Resource repository on the Operation server. In that case, the server will provide the identity of the Resource in the returned Resources. When Resources that are not persisted are returned in a response, they will have no *id* property.

### Executing an Operation Asynchronously

**DSTU Note:** No correct way to execute operations asynchronously is defined. The [messaging page](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html#operations) describes a way to execute operations asynchronously using messages.

Feedback/discussion [here](http://wiki.hl7.org/index.php?title=FHIR_Asynchronous_Exchange).

# overview-clinical.html

## FHIR Overview - Clinicians

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR (*Fast Health Interoperability Resources*) is designed to enable the exchange of healthcare-related information. This includes clinical data as well as healthcare-related administrative and public health and research data. It covers both human and veterinary medicine, and is intended to be useable globally, and in a wide variety of contexts including in-patient, ambulatory care, acute care, long-term care, community care, allied health, etc.

The FHIR specification is targeted to individuals and organizations developing software and architecting interoperable solutions that will be using FHIR to create systems. The FHIR specification does not attempt to define good or best clinical practices, nor does it provide guidance on user interfaces or workflows. Guidance in these areas may be useful, but is outside of FHIR's scope.

Because of FHIR's implementation focus, many aspects of the specification deal with the technical underpinings of the exchange of clinical information between electronic systems. This section provides an introduction to what FHIR provides, and tries to highlight those portions of the specification that are likely to be of the greatest interest to the clinical community while skipping over some of the technical minutiae of interoperability. However, if technical drudgery is your thing, feel free to dig right in wherever you wish.

### Resources

From a clinical perspective, the most important parts of the FHIR specification to understand are the Resources. Think of Resources as "forms" reflecting different types of clinical and administrative information that can be captured and shared. The FHIR specification defines a generic "form template" for each type of clinical information - so one for allergies, one for prescriptions, one for referrals, etc.

FHIR data consists of repositories containing completed “forms”, or Resource instances. The Resource instances will describe patient related information such as demographics, conditions, and procedures as well as administrative information such as practitioners, organizations, and locations. Some Resources are infrastructure components used to support the technical exchange of information and describe what systems can do, define allowed sets of codes, etc. FHIR repositories might be elecronic health record (EHR) systems, pharmacy systems, hospital information systems (HISs), etc. Some systems, such as clinical decision support (CDS) engines, may expose FHIR interfaces even though they don't actually store any information.

Each Resource contains a small amount of highly-focused data. A single Resource doesn't say very much, but many resources together create a useful clinical record. Information systems map the actions that a user takes (look up patient records, make a note in their history, etc) to operations on the relevant Resources.

### Extensibility and Profiling

The “forms” (Resources) in FHIR are somewhat generic since they have to be useable in different countries, and by different types of clinicians in different contexts (human care, veterinary care, public health, research, etc). FHIR recognizes that a *one size fits all* approach is not appropriate in the healthcare space, so it provides the ability to adjust the forms to be able to handle the needs of different implementation spaces by adding additional "extensions" as well as enforcing constraints. For example, a "prescription" form might have extension elements added to support tracking of restricted medications while also constraining what codes can be used to communicate types of drugs to a particular national standard. However, the forms are designed in such a way that these changes can be made without changing how systems pass forms around. Thus any system can consume completed forms even if they have "extra" elements added, and whether or not those extra elements are used by the receiving system.

To keep the base forms that everyone uses from being overly complex, FHIR has a rule that, in most cases, a resource will only include data elements if there's an expectation that most implementations will use that particular data element. That doesn't mean the data must always exist. For example, most systems in the world are capable of tracking "deceased date" for patient, even though that element will be blank for many patient records. On the other hand, not so many systems track hair color, so hair color would be omitted from the base form, and those systems that need it (perhaps in a specialty clinical or research setting) can use a FHIR extension to capture it if needed.

To keep the number of resources reasonable, some of them are fairly broad. The [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) resource is used for vital signs, lab results, psychological assessments and a variety of other things. To set rules for more narrow areas (e.g. "*What should I send if I want to share a blood pressure?*"), FHIR allows the creation of Profiles. There will be a great deal of clinical work involved in forming consensus around how different types of detailed clinical information should be captured and shared in particular settings. Tooling to support the creation of Profiles directly by clinicians is part of the plan for FHIR, but is still in the very early stages.

### Narrative

FHIR is intended as a system for sharing discrete data between healthcare systems in a manner that supports computer interoperability - decision support, rules triggering, trend analysis, etc. However, not every system is the same, and not all systems are able to recognize all discrete data. Also, there is still considerable value in data exchange in circumstances where not all data is captured in a discrete manner. For this reason, FHIR resources support sharing not only discrete data for computation, but also a human-readable view so that the humans on each end of a healthcare information exchange can still get a full picture of what's going on.

Narrative is expected to exist for most resource instances, athough it can be omitted in a few limited circumstances. In some cases the narrative will be generated from discrete information. For example the narrative for a patient might look like this:

|  |
| --- |
| **Peter James Chalmers (OFFICIAL), Jim** **identifier**: MRN = 12345 (USUAL) **telecom**: ph: (03) 5555 6473(WORK) **gender**: MALE **birthDate**: Dec 25, 1974 **deceased**: false **address**: 534 Erewhon St PleasantVille Vic 3999 (HOME) |

In other cases, the narrative might be free form text commentary generated directly by a practitioner, and might include referral letters, pathology reports, etc. Certain parts of the narrative content could also later be exposed as discrete data.

### Interfaces

In addition to defining the "forms" for data exchange (Resources), FHIR also defines a set of interfaces by which systems actually share that information . There are four primary mechanisms or "paradigms" of exchange supported by FHIR: via a REST API, Documents, Messages, and/or Services.

#### REST

REST is the simplest exchange mechanism. Continuing the "form" metaphor, a RESTful server can be thought of as a room full of filing cabinets. Within the room is a cabinet for each "type" of form it supports. The cabinet contains folders where each folder has a unique number and represents one particular real-world thing: one Patient, one Encounter, one Medication, etc. Each folder (Resource instance) contains multiple pieces of paper, where each piece of paper represents a "version" of that real world thing. Every time someone updates a record, a new piece of paper is added to the top that file folder. To see the history of a Resource, you simply flip through the pieces of paper in the folder.

Note that a typical medical record is generally a big “folder of folders” with many different types of 'forms' or 'reports' gathered together. This is convenient for someone who wants to review the whole record, but inconvenient for updating bits of it; there's always contention for access to it to update the right part. In IT, the record will be decomposed to its smallest components for management purpose, and a computer will (or should), assemble the correct bits as required by following references from one piece of information to the next.

Now picture a clerk at the front door of that room. You can pass the clerk a requisition to have them do something with the information in those file cabinets. The "clerk" and set of requisition forms make up the FHIR restful API. With that API, you can do the following things:

* *search*: Search through the folders for ones that meet a set of search criteria
* *read*: Get a copy of the top piece of paper (which is the most current version) from a specific folder in one of the cabinets
* *create*: Add a new folder to the appropriate cabinet (with a new number)
* *update*: Add a new page (version) to the contents of a specific folder
* *delete*: Remove a folder from the cabinet (or more accurately, virtually remove it by putting a sticker on it saying "do not open")
* *history*: Look at all the pages in a single folder, in a particular file cabinet, or in the whole room, although such a broad request would be primarily for an administrative purpose rather than for a clinical purpose
* *transaction*: Give the server multiple folders all at once to update
* *operation*: Ask the server to perform a procedure on one or more records that it has

EHRs and other systems may present a more sophisticated interface to their end users, but behind the scenes, they’re all making these types of requests to the same file clerk.

#### Documents

Documents are a familiar mechanism for sharing information in the healthcare space. They are useful whenever there's a desire to guide how a consumer of information will navigate it and there's a need to have a "frozen" view of information that can be reliably retrieved even years in the future. Examples of document-like things in healthcare include discharge summaries and lab reports.

In FHIR, there's a special resource called [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) that acts as the "cover page" for a document. It identifies the title, author date, relevant patient and the table of contents. A FHIR document can be thought of as a set of sheets (Resource *instances*) stacked together with a title page on top that’s stapled together. That stapled collection can then be stored or passed around, conveying a whole set of information at once.

#### Messaging

Much healthcare information exchange happens using a messaging paradigm. In messaging, a collection of information is sent from one system to another with an explicit request to "do something". A message might request that a lab order be fulfilled or that two patient records be merged or notify a system that a patient has been transferred from one bed to another. Messaging is similar to documents in that it collects resources together. However, in this case, the cover page is a [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) that acts as a requisition. And rather than a staple, the resources are joined together with a paper-clip. There's no expectation that the receiving system will store the data exactly as received.

#### Services

Services can be thought of as a light-weight way of doing messaging. Rather than a full cover page, a small sticky note is attached to the front of a resource. And sometimes rather than sending a full piece of paper, the relevant pieces are cut out and sent as fragments. The response to a requisition is a similarly paper-clipped bundle of resource instances. Services are likely to be used for things like decision support. e.g. "Is there a problem with prescribing medication X for patient Y?", "What's the recommended care plan for a patient with conditions A, B and C?"

### Approaching the specification

A FHIR-based system's capabilities are defined by what the resources can say, and from a clinical perspective, these things define the clinical record:

* the kinds of resources that are defined
* their data contents, and rules about the data such as what terminology codes are supported and/or required
* how resources link to each other
* how you can search for information

This information can all be found in the resource definition pages. The resources most likely to be of interest can be found on the [Clinical](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinical.html) and [Administrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html) pages. Instructions on how to interpret the information found on the resource pages can be found [here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html). The *Logical table* or *UML* views are likely to be easiest to understand. Also, don't forget to look at the examples tab for an idea of what kind of information can be expressed. Seeing how elements are used to convey real data is often more useful than just looking at definitions. Also, look at the Profiles tab to see examples of how different resources can be constrained for use in particular contexts.

Clinician and other domain expertise and feedback is always welcome as we continue refining the FHIR specification. At the top of each resource page is a link to the home page for the work group responsible for that particular resource. If you have feedback on resource design, consider getting involved.

# overview-dev.html

## FHIR Overview - Developers

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR (*Fast Health Interoperability Resources*) is designed to enable information exchange to support the provision of healthcare in a wide variety of processes. The specification builds on and adapts well-known and widely used RESTful practices to enable the provision of integrated healthcare across a wide range of teams.

The intended scope of FHIR is broad, covering human and veterinary, clinical care, public health, clinical trials, administration and financial aspects. The standard is intended for global use in a wide variety of architectures and scenarios.

### Framework

FHIR is based on "Resources" which are the common building block for all exchanges. Each resource has the following [common features](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html):

* A URL that identifies it
* Common metadata
* A [human-readable XHTML summary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* A set of defined common data elements
* An [extensibility framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) to support variation in healthcare

Resources are represented as either [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html). There are currently nany different [resource types defined](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) in the FHIR specification.

### Example Resource

This is an example of how a [patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) is represented as a FHIR object in [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html). An [XML encoding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) is also defined in the specification.

{

"resourceType": "Patient",

"id" : "23434",

"meta" : {

"versionId" : "12",

"lastUpdated" : "2014-08-18T15:43:30Z"

}

"text": {

"status": "generated",

"div": "<!-- Snipped for Brevity -->"

},

"extension": [

{

"url": "http://example.org/consent#trials",

"valueCode": "renal"

}

],

"identifier": [

{

"use": "usual",

"label": "MRN",

"system": "http://www.goodhealth.org/identifiers/mrn",

"value": "123456"

}

],

"name": [

{

"family": [

"Levin"

],

"given": [

"Henry"

],

"suffix": [

"The 7th"

]

}

],

"gender": {

"text": "Male"

},

"birthDate": "1932-09-24",

"active": true

}

Each resource consists of:

* **resourceType** (line 2) - Required: FHIR defines many different types of resources. See [the full index](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html)
* **id** (line 3) - The id of the resource. Always present when a resource is exchanged, except during the create operation (below)
* **meta** (lines 4 - 7) - Usually Present: [Common use/context data to all resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta) and managed by the infrastructure. Missing if there is no metadata
* **text** (lines 12 - 17) - Recommended: XHTML that provides a [human readable representation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) for the resource
* **extension** (lines 12 - 17) - Optional: [Extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) defined by the extensibility framework
* **data** (lines 18 - 43) - Optional: data elements defined for each type of resource

Note that though this specification always shows the JSON properties in the order they are defined, many JSON libraries order properties by other criteria.

### Interactions

For manipulation of resources, FHIR provides a [REST API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) with a rich but simple set of interactions:

* [Create](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#create) = POST https://example.com/path/{resourceType}
* [Read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) = GET https://example.com/path/{resourceType}/{id}
* [Update](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#update) = PUT https://example.com/path/{resourceType}/{id}
* [Delete](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#delete) = DELETE https://example.com/path/{resourceType}/{id}
* [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) = GET https://example.com/path/{resourceType}?search parameters...
* [History](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#history) = GET https://example.com/path/{resourceType}/{id}/\_history
* [Transaction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#transaction) = POST https://example.com/path/ *(POST a tranasction bundle to the system)*
* [Operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) = GET https://example.com/path/{resourceType}/{id}/${opname}

The FHIR specification describes other kinds of exchanges beyond this simple RESTful API, including exchange of groups of resources as [Documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html), [Messages](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html), and by using other kinds of [services](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html).

### Managing Variability

There is a wide variation between different jurisdictions and segments of the Healthcare industry, and no central authority to imposes common business practices. Because of this, the FHIR specification defines a[n extension framework](file:///C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\extensibility.html), as well as [a framework for managing variability](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html).

Another key aspect of the variability encountered in healthcare is that the same information may be represented differently, and with different levels of detail, granularity and nesting by various parties across the system. For example, in some cases a blood pressure measurement may be just a simple observation, a vital sign measure, while in other cases can be a rich set of highly controlled data that includes things like controlled vocabularies for posture, exercise etc. The [resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) defined in this specification focus on the general, common use cases. Richer and more specific content can be standardised by [defining "profiles"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) on the base resources.

### Creating a resource

To [create a Resource](file:///C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\http.html" \l "create), send an HTTP POST request to the resource's respective end point.

POST https://example.com/path/{resourceType}

In the example below we see the creation of a Patient.

POST {some base path}/Patient HTTP/1.1

Authorization: Bearer 37CC0B0E-C15B-4578-9AC1-D83DCED2B2F9

Accept: application/json+fhir

Content-Type: application/json+fhir

Content-Length: 1198

{

"resourceType": "Patient",

...

}

Submit a new patient to the server, and ask it to store the patient with an id of its own choice.

Notes:

* **/Patient** (line 1) - the manager for all patients - use the name of the type of resource
* **Authorization** (line 2) - see [Security for FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html)
* **Accept, Content-Type** (lines 3-4) - the content type for all FHIR resources as represented in JSON (or application/xml+fhir for the XML version). FHIR resources are always represented in UTF-8
* **id** (line 9) - No id for a resource that is being created - the server will assign one
* Resource Content, lines 8+ - There's no meta property at this point. The rest of the resource is the same content as above

### Create Response

A response will contain an HTTP code 201 to indicate that the Resource has been created successfully. A location header indicates where the resource can be fetched in subsequent requests. The server may choose to return an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource, but is not required to do so.

HTTP/1.1 201 Created

Content-Length: 161

Content-Type: application/json+fhir

Date: Mon, 18 Aug 2014 01:43:30 GMT

ETag: "1"

Location: http://example.com/Patient/347

{

"resourceType": "OperationOutcome",

"text": {

"status": "generated",

"div": "<div xmlns=\"http://www.w3.org/1999/xhtml\">The operation was successful</div>"

}

}

Notes:

* **HTTP/1.1 201** (line 1) - the operation was successful. Note that HTTP/1.1 is strongly recommended but not required
* **ETag** (line 5) - used in the [version aware update](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#update) pattern
* **Location** (line 6) - the id the server assigned to the resource. The id in the url must match the id in the resource when it is subsequently returned
* **operationOutcome** (line 9) - OperationOutcome resources in this context have no id or meta element (they have no managed identity)

#### Error response

For a variety of reasons, servers may need to return an error. Clients should be alert to authentication related errors, but FHIR content related errors should be returned using an appropriate HTTP status code, with an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource to provide additional information. Here is an example of a server rejecting a resource because of server defined business rules:

HTTP/1.1 422 Unprocessable Entity

Content-Length: 161

Content-Type: application/json+fhir

Date: Mon, 18 Aug 2014 01:43:30 GMT

{

"resourceType": "OperationOutcome",

"text": {

"status": "generated",

"div": "<div xmlns=\"http://www.w3.org/1999/xhtml\">MRN conflict

- the MRN 123456 is already assigned to a different patient</div>"

},

}

Notes:

* The server can return additional structured information using the details of the [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html)

### Read Request

[Reading a resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) is done by sending HTTP GET requests to the desired Resource end point.

GET https://example.com/path/{resourceType}/{id}

Here's an example.

GET /Patient/347?\_format=xml HTTP/1.1

Host: example.com

Accept: application/xml+fhir

Cache-Control: no-cache

Notes:

* **347** (line 1) - The id of the resource that is being fetched
* **\_format=xml** (line 1) - this is another method for clients to indicate the desired response format, in addition to using the accept header, and is useful for clients that don't have access to the HTTP Headers (e.g. XSLT transforms) (see [Mime Types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#mimetypes))
* **cache control** (line 4) - Concurrency control is important, though FHIR itself says nothing about it - see <http://www.w3.org/Protocols/rfc2616/rfc2616-sec13.html> or <https://www.mnot.net/cache_docs/>

### Read Response

The response to a GET contains the Resource.

HTTP/1.1 200 OK

Content-Length: 729

Content-Type: application/xml+fhir

Last-Modified: Sun, 17 Aug 2014 15:43:30 GMT

ETag: "1"

<?xml version="1.0" encoding="UTF-8"?>

<Patient xmlns="http://hl7.org/fhir">

<id value="347"/>

<meta>

<versionId value="1"/>

<lastUpdated value="2014-08-17T15:43:30Z"/>

</meta>

<!-- content as shown above for patient -->

</Patient>

Notes:

* **id** (line 9) - The id of the resource. This must match the id in the read request
* **versionId** (line 11) - The current version id of the resource. Best practice is that this value matches the ETag (see [version aware update](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#update)), but clients must never assume this. Note that some servers do not track the version of the resource
* Note that servers are not required to support versioning, but are strongly encouraged to do so
* **lastUpdated** (line 12) - if present, this must match the value in the HTTP header

### Search Request

In addition to getting single known resources, it’s possible to find resources by [searching the resource end point](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) with a [set of criteria](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) describing the set of resources that should be retrieved and their order. The general pattern is:

GET https://example.com/path/{resourceType}?criteria

The criteria is a set of http parameters that specify which resources to return. The search operation

https://example.com/base/MedicationOrder?patient=347

returns all the prescriptions for the patient created above.

### Search Response

The response to a search request is a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html): list of matching resources with some metadata:

HTTP/1.1 200 OK

Content-Length: 14523

Content-Type: application/xml+fhir

Last-Modified: Sun, 17 Aug 2014 15:49:30 GMT

{

"resourceType": "Bundle",

"type": "searchset",

"id" : "eceb4882-5c7e-4ca4-af62-995dfb8cef01"

"meta" : {

"lastUpdated" : "2014-08-19T15:49:30Z"

},

"total": "3",

"link": [

{

"relation" : "next",

"url" : "https://example.com/base/MedicationOrder?patient=347&searchId=ff15fd40-ff71-4b48-b366-09c706bed9d0&page=2"

}, {

"relation" : "self",

"url" : "https://example.com/base/MedicationOrder?patient=347"

}

],

"entry": [

{

"resource" : {

"resourceType": "MedicationOrder",

"id" : "3123",

"meta" : {

"versionId" : "1",

"lastUpdated" : "2014-08-16T05:31:17Z"

},

... content of resource ...

},

},

... 2 additional resources ....

]

}

Notes:

* **resourceType/type** (line 7/8) - the result of a search is always a bundle of type "searchset"
* **id** (line 9) - An identifier assigned to this particular bundle. The server should assign a unique id to this bundle that it will not be re-used
* **meta.lastUpdated** (line 11) - This should match the HTTP header, and should be the date the search was executed, or more recent, depending on how the [server handles ongoing updates](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#currency). The lastUpdated data SHALL be the same or more recent than the most recent resource in the results
* **total** (line 14) - The total number of matches in the search results. Not the number of matches in this particular bundle, which may be a [paged view into the results](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search)
* **link** (line 15) - A set of named links that give related contexts to this bundle. Names defined in this specification: [first](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search), [prev](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search), [next](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search), [last](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search), [self](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search)
* **entry** (line 24) - Actual resources in this set of results
* **entry.resource.id** (line 27) - Note that in some bundles, the **entry.resource.id** must be [unique in the bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle-unique)
* the search operation is also able to [return additional related resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#include) as well

### Update Request

The client sends the server a new version of the resource to replace the existing version - it PUTs it to the location of the existing resource:

PUT https://example.com/path/{resourceType}/{id}

Note that there does not need to be a resource already existing at {id} - the server may elect to automatically create the resource at the specified address. Here is an example of updating a patient:

PUT /Patient/347 HTTP/1.1

Host: example.com

Content-Type: application/json+fhir

Content-Length: 1435

Accept: application/json+fhir

If-Match: 1

{

"resourceType": "Patient",

"id" : "347",

"meta" : {

"versionId" : "1",

"lastUpdated" : "2014-08-18T15:43:30Z"

},

...

}

Notes:

* **resourceType** (line 1) - "Patient" in the url must match the resource type in the resource (line 9)
* **resource id** (line 1, "347") - This must match the id in the resource (line 10)
* **If-Match** (line 6) - if this is provided, it must match the value in meta.versionId (line 12), and the server must check the version integrity, or return 412 if it doesn't support versions
* **meta.lastUpdated** (line 10) - This value is ignored, and will be updated by the server
* **resource content** (line 14) - Not shown here, the same as Patient above

### Update Response

The response to an update request has metadata / status, and optionally an OperationOutcome:

HTTP/1.1 200 OK

Content-Length: 161

Content-Type: application/json+fhir

Date: Mon, 18 Aug 2014 01:43:30 GMT

ETag: "2"

{

"resourceType": "OperationOutcome",

"text": {

"status": "generated",

"div": "<div xmlns=\"http://www.w3.org/1999/xhtml\">The operation was successful</div>"

}

}

Notes:

* **ETag** (line 5) - This is the versionId of the new version, and is also found as a fixed URL in line 6

### Base Resource Content

Here is an example that shows all the information found in all resources, fully populated:

{

"resourceType" : "X",

"id" : "12",

"meta" : {

"versionId" : "12",

"lastUpdated" : "2014-08-18T15:43:30Z",

"profile" : ["http://example-consortium.org/fhir/profile/patient"],

"security" : [{

"system" : "http://hl7.org/fhir/v3/ActCode",

"code" : "EMP"

}],

"tag" : [{

"system" : "http://example.com/codes/workflow",

"code" : "needs-review"

}]

},

"implicitRules" : "http://example-consortium.org/fhir/ehr-plugins",

"language" : "X"

}

Implementers notes:

* **resourceType** (line 2) - always found in every resource. In XML, this is the name of the root element for the resource
* **id** (line 3) - defined when the resource is created, and never changed. Only missing when the resource is first created
* **meta.versionId** (line 5) - changes each time any resource contents change (except for the last 3 elements in meta)
* **meta.lastUpdated** (line 6) - Changes when the versionId changes. Systems that don't support versions usually don't track lastUpdated either
* **meta.profile** (line 7) - An assertion that the content conforms to a profile. See [Extending and Restricting Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#resources) for further discussion. Can be changed as profiles and value sets change or the system rechecks conformance
* **meta.security** (lines 8 - 11) - [Security labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) applied to this resource. These tags connect resources in specific ways to the overall security policy and infrastructure. Security tags can be updated when the resource changes, or whenever the security sub-system chooses to
* **meta.tag** (lines 12 - 16) - [Tags](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html) applied to this resource. Tags are used to relate resources to process and workflow. Applications are not required to consider the tags when interpreting the meaning of a resource. Tags can be [updated](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#tags) without changing the resource version
* **implicitRules** (line 17) - indicates that there is a [custom agreement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#agreement) about how the resources are used that must be understood in order to safely process the resource. Use of this is discouraged because it restricts sharing, but sometimes necessary
* **language** (line 18) - The [base language of the resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html#language). The resource is allowed to have content from other languages; this is just the base, but should be the main language of the resource

Want more information?

* [Resource Index](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourceglist.html)
* [Resource Guide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourceguide.html)
* [Implementation Home](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementation.html)
* [Documentation Index](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentation.html)
* [Support Links](http://wiki.hl7.org/index.php?title=FHIR_Support_Page)

# overview.html

## FHIR Overview

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N?A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Welcome to the FHIR (Fast Healthcare Interoperability Resources) Specification, which is a standard for exchanging healthcare information electronically. This page provides an overview of the standard, and serves as a road map for first-time readers of the specification to help find your way around FHIR quickly.

### Background

Healthcare records are increasingly becoming digitized. As patients move around the healthcare eco-system, their electronic health records must be available, discoverable, and understandable. Further, to support automated clinical decision support and other machine based processing, the data must also be structured and standardized. (See [Coming digital challenges in healthcare](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\change.html))

[HL7](http://hl7.org) has been addressing these challenges by producing healthcare data exchange and information modeling standards for over 20 years. FHIR is a new specification based on emerging industry approaches, but informed by years of lessons around requirements, successes and challenges gained through defining and implementing HL7 v2, v3 and the RIM, and CDA. FHIR can be used as a stand-alone data exchange standard, but can and will also be used in partnership with existing widely used standards. (See [Comparing FHIR to other HL7 standards](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison.html))

FHIR aims to simplify implementation without sacrificing information integrity. It leverages existing logical and theoretical models to provide a consistent, easy to implement, and rigorous mechanism for exchanging data between healthcare applications. FHIR has built-in mechanisms for traceability to the HL7 RIM and other important content models. This ensures alignment to HL7's previously defined patterns and best practices without requiring the implementer to have intimate knowledge of the RIM or any HL7 v3 derivations. (See [Comparing FHIR to other HL7 standards](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison.html))

### Components

The basic building block in FHIR is a [Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html). All exchangeable content is defined as a resource. Resources all share the following set of characteristics:

* A common way to [define](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html) and [represent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html) them, building them from [data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) that define common reusable patterns of elements
* A common set of [metadata](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata)
* A [human readable](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) part

### Approach

#### Approach to information modeling

The philosophy behind FHIR is to build a base set of resources that, either by themselves or when combined, satisfy the majority of common use cases. FHIR resources aim to define the information contents and structure for the core information set that is shared by most implementations. There is a [built-in extension mechanism](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) to cover the remaining content as needed.

FHIR modeling uses a composition approach. In comparison, HL7 v3 modeling is based on "model by constraint" (see [Comparing FHIR to other HL7 standards](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison.html)). With FHIR, specific use cases are usually implemented by combining resources together through the use of [resource references](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html). Although a single resource might be useful by itself for a given use case, it is more common that resources will be combined and tailored to meet use case specific requirements. Two special kinds of resources are used to describe how resources are combined and used:

* [Conformance Statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) â€“ describes the interfaces that an implementation exposes for exchange of data
* [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) - provide additional rules that serve to constrain the optionality, cardinality, terminology bindings, data types and extensions defined in the resources used by the implementation

### The Specification

Broadly, the FHIR specification is broken up into 3 parts:

* General [documentation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentation.html) that describes how [resources are defined](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html), and gives background material including definitions of [data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html), [codes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html), and the [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) and [JSON formats](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)
* [Implementation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementation.html) - how to use resources using [REST](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), [Messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html), as [clinical documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html), or in a [service based architecture](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html)
* The [resource list](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) - a list of all the resources defined by FHIR. You can also get lists for [clinical](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinical.html), [administrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html) and [infrastructural](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\infrastructure.html) resources

Resources have a wide range of uses, from pure clinical content such as [care plans](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html) and [diagnostic reports](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) through to pure infrastructure such as [Message Header](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) and [conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) statements. They all share common technical characteristics (see below for a more formal definition), but they are used in totally different fashions. Note that you do not have to use REST to make use of resources.

### Where to Start

The best place to start is to quickly read the [Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) list to get a sense of what resources exist and then look at the [Patient resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) definition to see what resource definitions look like, and then read these background pages:

* [Resource Definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html) - basic background to how resources are defined
* About Resources: the [Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html) they all contain, and how [Resources refer to each other](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html)
* [Formats](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html): [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html) and [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html)
* About [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html): a key way that the specification is kept simple
* If you are coming to FHIR with a background in another HL7 standard (v2, v3 or CDA), [The Relationship between FHIR and other HL7 Standards](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\comparison.html) may also be useful

#### Header Tabs

These header tabs found through-out the specification are important, and many readers miss them:

Resources and the [data types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) that they use are presented in an concise easy to read XML-like format, but they also have detailed descriptions that describe their contents in considerable detail. In addition, most resources are mapped to several different formats, including HL7 v2, the HL7 v3 RIM, CDA, DICOM, and others. Also, all resources come with at least one example (sometimes many more) and, where appropriate, with profiles that describe their use in specific circumstances. Finally, some resources include notes that helps implementers understand the design rationale underlying them.

### Finding Additional Information and Providing Feedback

While intended to be consumable by a variety of audiences, the FHIR specification is targeted to the implementation community - those who will actually write the software that uses the specification. To help meet the needs of the implementation community, the editors have strived to keep the specification concise to reduce the amount of reading that must be done before writing useful code. (The specification isn't nearly as brief as we'd like - sometimes the complexity of healthcare and the real world get in the way.) For this reason, information that is not essential to the implementation process, such as rationale, considered alternatives, points of contention, future plans, etc. have been excluded from this specification. As well, it is likely that from time-to-time, implementers will encounter situations where the specification is unclear or incomplete. Finally, there will be circumstances where the specification may be broken or where a change could allow it to better meet implementer needs.

HL7 has therefore provided a number of mechanisms through which additional information about FHIR can be sought and maintained and through which support and requests for change can be made.

#### Comments

Each page includes a "comments" section at the bottom of the page where questions and discussion about that particular portion of the FHIR specification can occur. The comments will be actively monitored by FHIR editors and HL7 work groups, so questions should be answered in a fairly timely fashion. This content will occasionally be curated to ensure ongoing relevance, particularly if the specification is subsequently updated to eliminate confusion that may have spawned an initial comment.

#### The FHIR Wiki

The FHIR project team also maintains a [wiki](http://wiki.hl7.org/index.php?title=FHIR) where development processes, methodology and design decisions are documented. Implementers and others can also contribute to the wiki to provide additional guidance and supplemental information not found in the specification. Note that wiki content is not authoritative and is not relevant for determining conformance to the FHIR specification. As well, some wiki content may not be up to date with the most recent version of the FHIR specification.

A wiki page exists for each page in the FHIR specification. These pages will generally be used to capture background rationale, decision points and other information not relevent to implementers. Additional pages defined include [FHIR methodology](http://wiki.hl7.org/index.php?title=FHIR_Guide_to_Designing_Resources), use of the [FHIR design tools](http://wiki.hl7.org/index.php?title=FHIR_Guide_to_Authoring_Resources), etc. To explore the FHIR wiki, you can start at the [root page](http://wiki.hl7.org/index.php?title=FHIR)

#### Formal Change requests

Formal requests for change can be submitted [here](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemAdd&tracker_id=677). (There's a link at the bottom of each page as well.) These will be reviewed by the appropriate work group and a decision made on their incorporation into the specification, including which release (if any) they will be part of.

#### Additional Information sources/Engagement Mechanisms

In addition to the above mechanisms, HL7 provides a Stack Overflow tag, list servers and mass Skype chats to provide various levels of implementer support and engagement. Instructions for accessing these other mechanisms (and instructions for how best to make use of them) can be found at the [Support Links](http://wiki.hl7.org/index.php?title=FHIR_Support_Page) (and also [here](http://wiki.hl7.org/index.php?title=FHIR#More_help_and_Asking_Questions)).

# page.html

# profile.html

See here: [this link](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html).

# profilelist.html

## Profiles defined as part of FHIR

This specification is a common platform standard that must be [adapted to particular use cases](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html). Some particular use cases are common or important enough to be described as a part of the specification itself. These are published as a "Profile" - a group of [Structure Definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) (Constraints or Extensions), [Value Sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html), and examples that are all defined with a common purpose. Additional profiles may be registered on the HL7 FHIR registry at <http://fhir.org/registry>

Implementation Guides that define profiles: .

# profiling-examples.html

## Slicing and Discriminator Examples

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Slicing Patient Contact Details

One common use of slicing is to describe different constraints on different kinds of patient contact details. This is defined as Patient.telecom : ContactPoint [0..\*] where the ContactPoint has system, value and use.

Consider the case where the profile should say:

* There must be a single home phone number
* The patient may have a work phone number
* The patient may have an email address
* No other types of contact are allowed

An example of a patient resource that meets these rules:

<Patient>

... snip ...

<telecom>

<system value="phone" />

<use value="home" />

<value value="5551234567" />

</telecom>

<telecom>

<system value="email" />

<value value="someone@acme.org" />

</telecom>

... snip ...

</Patient>

To do this, the profile that implements these rules needs to do the following:

* On the base Patient.telecom element: define that slicing is discriminated by system and use, and that the slices are closed ("No other types of contact are allowed"). Order is left unfixed
* Then define 3 slices:
  1. home phone: fixed values for system and use, and cardinality 1..1
  2. work phone: fixed values for system and use, and cardinality 0..1
  3. email: fixed value for system, cardinality 0..0 for use, and cardinality 0..1

In a StructureDefinition, this will look like:

<!-- setting up the slicing -->

<element>

<path value="Patient.telecom"/>

<slicing>

<discriminator value="system"/>

<discriminator value="use"/>

<rules value="closed"/>

</slicing>

<!-- net cardinality rules -->

<min value="1"/>

<max value="3"/>

</element>

<!-- first slice: home phone -->

<element>

<path value="Patient.telecom"/>

<name value="HomePhone"/> <!-- mandatory - gives the slice a name -->

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Patient.telecom.system"/>

<min value="1"/>

<fixedCode value="phone"/>

</element>

<element>

<path value="Patient.telecom.value"/>

<min value="1"/>

</element>

<element>

<path value="Patient.telecom.use"/>

<min value="1"/>

<fixedCode value="home"/>

</element>

<!-- second slice: work phone -->

<element>

<path value="Patient.telecom"/>

<name value="WorkPhone"/> <!-- mandatory - gives the slice a name -->

<min value="0"/>

<max value="1"/>

</element>

<element>

<path value="Patient.telecom.system"/>

<min value="1"/>

<fixedCode value="phone"/>

</element>

<element>

<path value="Patient.telecom.value"/>

<min value="1"/>

</element>

<element>

<path value="Patient.telecom.use"/>

<min value="1"/>

<fixedCode value="work"/>

</element>

<!-- thrid slice: email -->

<element>

<path value="Patient.telecom"/>

<name value="Email"/> <!-- mandatory - gives the slice a name -->

<min value="0"/>

<max value="1"/>

</element>

<element>

<path value="Patient.telecom.system"/>

<min value="1"/>

<fixedCode value="email"/>

</element>

<element>

<path value="Patient.telecom.value"/>

<min value="1"/>

</element>

<element>

<path value="Patient.telecom.use"/>

<min value="0"/>

</element>

Note: lots of definition detail has been left out, and only the parts relevant to the pattern are shown. Also, providing a fixed value makes the minimum cardinality irrelevant, but it is shown here for completeness.

This table illustrates the relationship between the instance and the ElementDefinitions:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Path** | **Name** | **Min** | **Max** | **Fixed** |
| <Patient> | Patient |  |  |  |  |
|  | Patient.telecom |  | 1 | 3 |  |
| <telecom> | Patient.telecom | HomePhone | 1 | 1 |  |
| <system value="phone" /> | Patient.telecom.system |  | 1 | 1 | phone |
| <value value="5551234567" /> | Patient.telecom.value |  | 1 | 1 |  |
| <use value="home" /> | Patient.telecom.use |  | 1 | 1 | home |
| </telecom> |  |  |  |  |  |
|  | Patient.telecom | WorkPhone | 0 | 1 |  |
| <telecom> | Patient.telecom | Email | 0 | 1 |  |
| <system value="email" /> | Patient.telecom.system |  | 1 | 1 | email |
| <value value="someone@acme.org" /> | Patient.telecom.value |  | 1 | 1 |  |
| </telecom> | Patient.telecom.use |  |  |  |  |

### Blood Pressure Example

Another use of Slicing is for Blood Pressure Measurements, where the profile says:

* There must be a two components
* The first has LOINC code 8480-6, and a quantity
* The second has LOINC code 8462-4, and a quantity
* Other components are allowed (posture, etc, but not profiled in the base blood pressure profile)

An example of an Observation resource that meets these rules:

<Observation>

... snip ...

<component>

<code>

<coding>

<system value="http://loinc.org" />

<code value="8480-6" />

<display value="Systolic blood pressure" />

</coding>

</code>

<valueQuantity>

<value value="120" />

<unit value="mmHg" />

<system value="http://unitsofmeasure.org" />

<code value="mm[Hg]" />

</valueQuantity>

</component>

<component>

<code>

<coding>

<system value="http://loinc.org" />

<code value="8462-4" />

<display value="Diastolic blood pressure" />

</coding>

</code>

<valueQuantity>

<value value="80" />

<unit value="mmHg" />

<system value="http://unitsofmeasure.org" />

<code value="mm[Hg]" />

</valueQuantity>

</component>

</Patient>

To do this, the profile that implements these rules needs to do the following:

* On the base Observation.component element: define that slicing is discriminated by code. Order is left unfixed, and rules left open
* Then define 2 slices:
  1. systolic: fixed values for code, cardinality 1..1, value is a Quantity
  2. diastolic: fixed values for code, cardinality 1..1, value is a Quantity

In a StructureDefinition, this will look like:

<!-- setting up the slicing -->

<element>

<path value="Observation.component"/>

<slicing>

<discriminator value="code"/>

</slicing>

<!-- net cardinality rules -->

<min value="2"/>

<max value="\*"/>

</element>

<!-- first slice: systolic -->

<element>

<path value="Observation.component"/>

<name value="systolic"/> <!-- mandatory - gives the slice a name -->

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Observation.component.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<code value="8480-6" />

<display value="Systolic blood pressure" />

</coding>

</fixedCodeableConcept>

</element>

<element>

<path value="Observation.component.valueQuantity"/>

<min value="1"/>

</element>

<!-- second slice: diastolic -->

<element>

<path value="Observation.component"/>

<name value="diastolic"/> <!-- mandatory - gives the slice a name -->

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Observation.component.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<code value="8462-4" />

<display value="Diastolic blood pressure" />

</coding>

</fixedCodeableConcept>

</element>

<element>

<path value="Observation.component.valueQuantity"/>

<min value="1"/>

</element>

Note: lots of definition detail has been left out, and only the parts relevant to the pattern are shown. e.g. A real blood pressure profile would fix units, a overall Observation code etc.

### Extensions

For another example, consider slicing extensions. The base extension on every element is defined as a list (0..\*) of extensions, and each extension has a url that identifies it, and a value. Consider an example where a profile defines that for a particular element (named Patient), there are two extensions, with URLs http://acme.com/a and http://acme.com/b. In addition, the profile allows other extensions to be used.

Technically, the profile achieves this by "slicing" the extension list, into two slices, and saying that the slicing is "open" - that there can be other slices introduced. Here's the relevant parts of the Profile on patient:

<StructureDefinition xmlns="http://hl7.org/fhir">

<!-- snip -->

<constrainedType value="Patient"/>

<snapshot>

<element>

<path value="Patient"/>

<!-- snip -->

</element>

<element>

<path value="Patient.extension"/>

<!-- this first element defines the slicing, and carries the base definition forward -->

<slicing>

<discriminator value="url"/> <!-- Extensions are always discriminated by URL -->

<ordered value="false"/> <!-- we don't care what order they appear in -->

<rules value="open"/> <!-- other extensions can be used -->

</slicing>

<!-- -- snip definition -->

</element>

<!-- first extension -->

<element>

<path value="Patient.extension"/>

<!-- snip most of definition -->

<type>

<code value="Extension"/>

<!-- the profile for an extension is a reference to the extension definition itself -

this implies a profile, and happens to fix the @url value to the desired URL -->

<profile value="http://acme.com/a"/>

</type>

</element>

<!-- second extension -->

<element>

<path value="Patient.extension"/>

<!-- snip most of definition -->

<type>

<code value="Extension"/>

<!-- the profile for an extension is a reference to the extension definition itself -

this implies a profile, and happens to fix the @url value to the desired URL -->

<profile value="http://acme.com/b"/>

</type>

</element>

<!-- snip rest of profile -->

</snapshot>

</StructureDefinition>

Here's a patient example that conforms to this profile:

<Patient xmlns="http://hl7.org/fhir">

<!-- two extensions, the order doesn't matter -->

<extension url="http://acme.com/b">

<!-- this has the right url, and so matches the second slice -->

<!-- snip whatever value extension would have -->

</extension>

<extension url="http://acme.com/a">

<!-- this has the right url, and so matches the first slice -->

<!-- snip whatever value extension would have -->

</extension>

<!-- the rest of patient -->

</Patient>

### Diagnostic Report & Observation

In this example, a profile on an diagnostic report says that it must have 4 observations, each with a different LOINC code (e.g. a classic lab panel). In this case (taken from the [Example Lipid Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lipid-report.html)), the structure that applies to DiagnosticReport will say that there is 4 slices on DiagnosticReport.result, each conforming to a different structure, which are also contained in the same profile. Each of those structures will constrain the LOINC code in the observation.

<!-- first structure, the DiagnosticReport -->

<StructureDefinition xmlns="http://hl7.org/fhir">

<!-- snip -->

<url value="http://acme.org/fhir/StructureDefinition/lipid-report"/>

<constrainedType value="DiagnosticReport"/>

<base value="http://hl7.org/fhir/StructureDefinition/DiagnosticReport"/>

<name value="LipidProfile"/>

<!-- snip -->

<snapshot>

<!-- snip elements -->

<element>

<!-- first definition for result -->

<path value="DiagnosticReport.result"/>

<slicing>

<!-- this is sliced by the code value of the target of the reference -->

<discriminator value="reference.code"/>

<!-- have to be in the specified order -->

<ordered value="true"/>

<!-- this profile says, no other observations allowed -->

<rules value="closed"/>

</slicing>

<!-- snip definition -->

</element>

<!-- first slice: Cholesterol -->

<element>

<path value="DiagnosticReport.result"/>

<name value="Cholesterol"/>

<!-- snip definition parts -->

<type>

<code value="Reference"/>

<!-- this element must conform to the "Cholesterol" structure -->

<profile value="http://acme.org/fhir/StructureDefinition/Cholesterol"/>

</type>

</element>

<!-- next 3 slices all the same, but different names for profile -->

<element>

<path value="DiagnosticReport.result"/>

<name value="Triglyceride"/>

<!-- snip definition parts -->

<type>

<code value="Reference"/>

<!-- this element must conform to the "Cholesterol" structure -->

<profile value="http://acme.org/fhir/StructureDefinition/Triglyceride"/>

</type>

</element>

<element>

<path value="DiagnosticReport.result"/>

<name value="LDLCholesterol"/>

<!-- snip definition parts -->

<type>

<code value="Reference"/>

<!-- this element must conform to the "Cholesterol" structure -->

<profile value="http://acme.org/fhir/StructureDefinition/LDLCholesterol"/>

</type>

</element>

<element>

<path value="DiagnosticReport.result"/>

<name value="HDLCholesterol"/>

<!-- snip definition parts -->

<type>

<code value="Reference"/>

<!-- this element must conform to the "Cholesterol" structure -->

<profile value="http://acme.org/fhir/StructureDefinition/HDLCholesterol"/>

</type>

</element>

<!-- snip elements -->

</snapshot>

</StructureDefinition>

<!-- now, the second structure, for the Cholesterol profile -->

<StructureDefinition>

<url value="http://acme.org/fhir/StructureDefinition/Cholesterol"/>

<constrainedType value="Observation"/>

<base value="http://hl7.org/fhir/StructureDefinition/Observation"/>

<name value="Cholesterol"/>

<snapshot>

<!-- snip elements -->

<element>

<!-- this the element definition for name. Because of the

slicing / discriminator rules in the LipidReport profile

that references it, it is required to fix the value of

the name element -->

<path value="Observation.code"/>

<definition>

<!-- there's actually 3 ways to fix a CodeableConcept

to a single fixed value. Here, we used the simplest one -->

<valueCodeableConcept>

<!-- just fix the value to the right code -->

<coding>

<system value="http://loinc.org"/>

<code value="35200-5"/>

<display value="Cholesterol"/>

</coding>

</valueCodeableConcept>

</definition>

</element>

<!-- snip elements -->

</snapshot>

</StructureDefinition>

<!-- Triglyceride profile -->

<StructureDefinition>

<url value="http://acme.org/fhir/StructureDefinition/Triglyceride"/>

<constrainedType value="Observation"/>

<base value="http://hl7.org/fhir/StructureDefinition/Observation"/>

<name value="Triglyceride"/>

<snapshot>

<!-- snip elements -->

<element>

<!-- this the element definition for name. Because of the

slicing / discriminator rules in the LipidReport profile

that references it, it is required to fix the value of

the name element -->

<path value="Observation.code"/>

<definition>

<!-- there's actually 3 ways to fix a CodeableConcept

to a single fixed value. Here, we used the simplest one -->

<valueCodeableConcept>

<!-- just fix the value to the right code -->

<coding>

<system value="http://loinc.org"/>

<code value="35217-9"/>

<display value="Triglyceride"/>

</coding>

</valueCodeableConcept>

</definition>

</element>

<!-- snip elements -->

</snapshot>

</StructureDefinition>

<!-- LDLCholesterol profile -->

<StructureDefinition>

<url value="http://acme.org/fhir/StructureDefinition/LDLCholesterol"/>

<constrainedType value="Observation"/>

<base value="http://hl7.org/fhir/StructureDefinition/Observation"/>

<name value="LDLCholesterol"/>

<snapshot>

<!-- snip elements -->

<element>

<!-- this the element definition for name. Because of the

slicing / discriminator rules in the LipidReport profile

that references it, it is required to fix the value of

the name element -->

<path value="Observation.code"/>

<definition>

<!-- because of the way that LDL cholesterol measurements works

(well, in this context- it varies), there's 2 different LOINC

codes for either measured or calculated. So here, we bind to

a value set -->

<binding>

<conformance value="required"/> <!-- must be required if this is a discriminator -->

<!-- snip the actual value set reference, but it refers to a value

set with two LOINC codes, one for each kind of LDL, which in

this case are LOINC codes 18262-6 and 13457-7 -->

</binding>

</definition>

</element>

<!-- snip elements -->

</snapshot>

</StructureDefinition>

<!-- HDLCholesterol profile -->

<StructureDefinition>

<url value="http://acme.org/fhir/StructureDefinition/HDLCholesterol"/>

<constrainedType value="Observation"/>

<base value="http://hl7.org/fhir/StructureDefinition/Observation"/>

<name value="HDLCholesterol"/>

<snapshot>

<!-- snip elements -->

<element>

<!-- this the element definition for name. Because of the

slicing / discriminator rules in the LipidReport profile

that references it, it is required to fix the value of

the name element -->

<path value="Observation.code"/>

<definition>

<!-- there's actually 3 ways to fix a CodeableConcept

to a single fixed value. Here, we used the simplest one -->

<valueCodeableConcept>

<!-- just fix the value to the right code -->

<coding>

<system value="http://loinc.org"/>

<code value="2085-9"/>

<display value="LDL Cholesterol"/>

</coding>

</valueCodeableConcept>

</definition>

</element>

<!-- snip elements -->

</snapshot>

</StructureDefinition>

Here is an instance that meets the rules for this profile:

<!-- first, the diagnostic report -->

<DiagnosticReport xmlns="http://hl7.org/fhir">

<!-- snip -->

<!-- here's the set of results. We don't know what

slices they are or anything until we go off, find

the references, and look in them -->

<result>

<reference value="Observation/cholesterol"/>

</result>

<result>

<reference value="Observation/triglyceride"/>

</result>

<result>

<reference value="Observation/ldlcholesterol"/>

</result>

<result>

<reference value="Observation/hdlcholesterol"/>

</result>

<!-- snip -->

</DiagnosticReport>

<!-- Observation, id = cholesterol -->

<Observation xmlns="http://hl7.org/fhir">

<!-- the observation starts with the name, as specified

by the profile for the first slice -->

<code>

<coding>

<system value="http://loinc.org"/>

<code value="35200-5"/>

<display value="Cholesterol"/>

</coding>

</code>

<!-- snip -->

</Observation>

<!-- Observation, id = triglyceride -->

<!-- this code matches the second slice. good -->

<Observation xmlns="http://hl7.org/fhir">

<code>

<coding>

<system value="http://loinc.org"/>

<code value="35217-9"/>

<display value="Triglyceride"/>

</coding>

</code>

<!-- snip -->

</Observation>

<!-- Observation, id = hdlcholesterol -->

<!-- this code matches the fourth slice. good -->

<Observation xmlns="http://hl7.org/fhir">

<code>

<coding>

<system value="http://loinc.org"/>

<code value="2085-9"/>

<display value="HDL Cholesterol"/>

</coding>

</code>

<!-- snip -->

</Observation>

<!-- Observation, id = ldlcholesterol -->

<!-- this code matches the third slice. good -->

<Observation id="ldlcholesterol">

<code>

<coding>

<system value="http://loinc.org"/>

<code value="13457-7"/>

<display value="LDL Chol. (Calc)"/>

</coding>

</code>

<!-- snip -->

</Observation>

Note that this version isn't valid, because the slices are not in the correct order:

<!-- first, the diagnostic report -->

<DiagnosticReport xmlns="http://hl7.org/fhir">

<!-- snip -->

<!-- here's the set of results. We don't know what

slices they are or anything until we go off, find

the references, and look in them -->

<result>

<reference value="Observation/cholesterol"/>

</result>

<result>

<reference value="Observation/triglyceride"/>

</result>

<result>

<reference value="Observation/hdlcholesterol"/>

</result>

<result>

<reference value="Observation/ldlcholesterol"/>

</result>

<!-- snip -->

</DiagnosticReport>

### Composition Sections

Most uses of Composition involve conformance to a profile that specifies which sections will exist, and what their contents will be. This is yet another example of slicing. A typical document content profile might specify a section structure something like this:

* Reason for visit Narrative, LOINC Code 29299-5
* Medications, LOINC Code 46057-6
  + Prescribed Medications, LOINC Code 66149-6
  + OTC medications, 66150-4 (optional)
* Vital Signs, LOINC Code 8716-3

Real profiles will contain lots of detail about the sections, but these are ommitted here in the interests of clarity.

An example of a Composition that meets these rules:

<Composition>

... snip ...

<section>

<code>

<coding>

<system value="http://loinc.org" />

<use value="29299-5" />

<value value="Reason for visit Narrative" />

</coding>

</code>

... snip ...

</section>

<section>

<code>

<coding>

<system value="http://loinc.org" />

<use value="46057-6" />

<value value="Medications section" />

</coding>

</code>

... snip ...

<section>

<code>

<coding>

<system value="http://loinc.org" />

<use value="66149-6" />

<value value="Prescribed medications" />

</coding>

</code>

... snip ...

</section>

<section>

<code>

<coding>

<system value="http://loinc.org" />

<use value="66150-4" />

<value value="Over the counter medications" />

</coding>

</code>

... snip ...

</section>

</section>

<section>

<code>

<coding>

<system value="http://loinc.org" />

<use value="8716-3" />

<value value="Vital signs" />

</coding>

</code>

... snip ...

</section>

</Composition>

To do this, the profile that implements these rules needs to do the following:

* On the base Composition.section element: define that slicing is discriminated by code, and that the slices are closed and ordered
* Then define 3 slices on Composition.section:
  1. reason-for-visit: fixed code, cardinality 1..1
  2. medication: fixed code, cardinality 1..1
  3. vital-signs: fixed code, cardinality 1..1
* Then, in the medication slice, slice the Composition.section.section: define that slicing is discriminated by code, and that the slices are closed and ordered
* Then define 3 slices on the Composition.section.section in medication:
  1. prescribed: fixed code, cardinality 1..1
  2. otc: fixed code, cardinality 0..1

In a StructureDefinition, this will look like:

<!-- setting up the slicing on Composition.section -->

<element>

<path value="Composition.section"/>

<slicing>

<discriminator value="code"/>

<ordered value="true"/>

<rules value="closed"/>

</slicing>

<!-- net cardinality rules -->

<min value="3"/>

<max value="3"/>

</element>

<!-- first slice: reason for visit -->

<element>

<path value="Composition.section"/>

<name value="reason-for-visit"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Composition.section.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<use value="29299-5" />

<value value="Reason for visit Narrative" />

</coding>

</fixedCodeableConcept>

</element>

<!-- second slice: medications -->

<element>

<path value="Composition.section"/>

<name value="reason-for-visit"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Composition.section.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<use value="46057-6" />

<value value="Medications section" />

</coding>

</fixedCodeableConcept>

</element>

<!-- setting up the inner slicing on medication Composition.section.section -->

<element>

<path value="Composition.section.section"/>

<slicing>

<discriminator value="code"/>

<ordered value="true"/>

<rules value="closed"/>

</slicing>

<!-- net cardinality rules -->

<min value="1"/>

<max value="2"/>

</element>

<!-- first inner slice: prescribed medications -->

<element>

<path value="Composition.section.section"/>

<name value="prescribed"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Composition.section.section.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<use value="66149-6" />

<value value="Prescribed medications" />

</coding>

</fixedCodeableConcept>

</element>

<!-- second inner slice: over the counter medications -->

<element>

<path value="Composition.section.section"/>

<name value="otc"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Composition.section.section.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<use value="66150-4" />

<value value="Over the counter medications" />

</coding>

</fixedCodeableConcept>

</element>

<!-- third slice: Vital Signs -->

<element>

<path value="Composition.section"/>

<name value="vital-signs"/>

<min value="1"/>

<max value="1"/>

</element>

<element>

<path value="Composition.section.code"/>

<min value="1"/>

<fixedCodeableConcept>

<coding>

<system value="http://loinc.org" />

<use value="8716-3" />

<value value="Vital signs" />

</coding>

</fixedCodeableConcept>

</element>

# profiling.html

## Profiling FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The base FHIR specification (this specification) describes a set of base resources, frameworks and APIs that are used in many different contexts in healthcare. However there is wide variability between jurisdictions and across the healthcare eco-system around practices, requirements, regulations, education and what actions are feasible and/or beneficial.

For this reason, the FHIR specification is a "platform specification" - it creates a common platform or foundation on which a variety of different solutions are implemented. As a consequence, this specification usually requires further adaptation to particular contexts of use. Typically, these adaptations specify:

* Rules about which resource elements are or are not used, and what additional elements are added that are not part of the base specification
* Rules about which API features are used, and how
* Rules about which terminologies and used in particular elements
* Descriptions of how the Resource elements and API features map to local requirements and/or implementations

Note that because of the nature of the healthcare eco-system, there may be multiple overlapping sets of adaptations - by healthcare domain, by country, by institution, and/or by vendor/implementation.

### Glossary

FHIR defines a cascade of artifacts for this purpose:

|  |  |  |
| --- | --- | --- |
| **Artifact** | **Description** | [**DAF**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html) **example** |
| Implementation Guide | A coherent and bounded set of adaptations that are published as a single unit. Validation occurs within the context of the Implementation Guide | [DAF IG](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html) |
| Package | A group of related adaptations that are published as a group within an Implementation Guide | [DAF Medication Usage](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf-medicationusage.html) |
| Conformance Item | A single resource in a package that makes rules about how an implementation works. These are described below | [DAF Prescription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\medicationorder-daf.html) |

The term "profile" is a general one that is used about either a "package" or an "item". "Profiling" is a general term that describes the process of creating an implementation guide, or any of the resources found in one.

### Conformance Resources

Typically, Implementation Guides both restrict and extend APIs, resources and terminologies. FHIR provides a set of resources that can be used to represent and share the decisions that have been made, and allows implementers to build useful services from them. These resources are known as the conformance resources. These conformance resources allow implementers to:

* Indicate that [some API calls](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) are not used for a particular use , and provide additional details about how the API calls are used ([Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) Resource)
* Add additional [operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) or [search parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) not in the base specification (using the [OperationDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) resource or the [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) Resource
* Define how a particular structure (Resource, Extension or Data Type) is used ([StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) Resource):
  + Describe how existing elements in resources are used
  + Identify existing elements that are not used
  + Define extensions that can be used in resources or data types
* Mix custom and standard terminologies and choose which codes from these to use for a particular use ([Value Set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) and StructureDefinition Resources)
* Map between local and standard terminologies or content models ([Concept Map](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) Resource)
* Register system namespaces for identifiers and terminologies ([NamingSystem](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\namingsystem.html) Resource)
* Describe and register specific Data Elements that are used across systems in a Data Dictionary ([DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) Resource)

These resources need to be used as discussed below, and also following the basic concepts for extension that are described in ["Extensibility"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html). For implementer convenience, the specification itself publishes its base definitions using these same resources.

### Two uses of Profiles

The [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) resource describes two different uses for profiles on resources: Resource Profiles and System Profiles. Resource Profiles are specified using *Conformance.rest.resource.profile* element and System Profiles are specified using *Conformance.profile* element.

#### Conformance.rest.resource.profile

These profiles describe the general features that are supported by the system for each kind of resource. Typically, this is the superset of all the different use-cases implemented by the system. This is a resource-level perspective of the system functionality.

#### Conformance.profile

These profiles describe the information handled/produced by the system on a per use case basis. Some examples of the uses for these kind of profiles:

* A Laboratory service producing a set of different reports - general chemistry, blood count, etc. Typical labs would support several hundred different reports
* A care manager which handles a set of different types of care plans and associated clinical resources
* A medications formulary that handles several different levels of sophistication in its medication representations

Typically, these profiles are a series of variations on the same set of resources - different use cases leading to handling the resources that represent them differently. These use-cases described above all pertain to system that produce and publish data, but the same concept applies to systems that consume data. For instance:

* An expert service that provides analysis on several different sets of data conforming to a particular pattern - tests x,y and z with particular codes and units

For producer and a consumer systems to exchange data successfully based on one of these system supported profiles, it's not enough to know that the systems happen to have system profiles that overlap for the use case of interest; the consumer must be able to filter the total set of resources made available by the producer system and deal only with the ones relevant to the use case.

As an example consider a laboratory system generating 1000s of reports a day. 1% of those reports are a particular endocrine report that a decision support system knows how to process. Both systems declare that they support the particular endocrine profile, but how does the expert system actually find the endocrine reports that it knows how to process?

One possible option is for the expert system to receive every single report coming from the lab system, check whether it conforms to the profile or not, and then decide whether to process it. Checking whether a resource conforms to a particular profile or not is a straight forward operation (one option is to use the [provided tools for this](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html)), but this is very inefficient way - the expert system has to receive and process 100 times many resources as it uses. To help a consumer find the correct set of reports for a use-case, a producer of resources also SHALL, for any profile declared in Conformance.profile:

1. [Mark resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta) with profile assertions documenting the profile(s) they conform to (this enables indexing by the profile)
2. (if a server) support searching by the [\_profile parameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#profile) for the declared profiles

Beyond these requirements, a producer of resources SHOULD ensure that any data that would reasonably be expected to conform to the declared profiles SHOULD be published in this form.

**DSTU Note:** there are many uninvestigated issues associated with this use of profiles. HL7 is actively seeking feedback from users who experiment in this area, and users should be prepared for changes to features and obligations in this area in the future.

Feedback [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

### Extending and Restricting the API

A conformance resource lists the REST interactions (read, update, search, etc) that a server provides or that a client uses, along with some supporting information for each. It can also be used to define a set of desired behavior (e.g. as part of a specification or a Request for Proposal). The only interaction that servers are required to support is the [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#conformance) interaction itself - to retrieve the server's conformance statement. Beyond that, servers and clients support and use whichever API calls are relevant to their use case.

In addition to the operations that FHIR provides, servers may provide additional operations that are not part of the FHIR specification. Implementers can safely do this by appending a custom operation name prefixed with '$' to an existing FHIR URL, as the [Operations framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) does. The Conformance resource supports defining what OperationDefinitions make use of particular names on an end point. If services are defined that are not declared using OperationDefinition, it may be appropriate to use longer names, reducing the chance of collision (and confusion) with services declared by other interfaces. The base specification will never define operation names with a "." in them, so implementers are recommended to use some appropriate prefix for their names (such as "ihe.someService") to reduce the likelihood of name conflicts.

Implementations are encouraged, but not required, to define operations using the standard FHIR operations framework - that is, to declare the operations using the OperationDefinition resource, but some operations may involve formats that can't be described that way.

Implementations are also able to extend the FHIR API using additional content types. For instance, it might be useful to [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) or [update](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#update) the appointment resources using a vCard based format. vCard defines its own mime type, and these additional mime types can safely be used in addition to those defined in this specification.

### Extending and Restricting Resources

Extending and restricting resources (collectively known as 'constraining a resource') is done with a "StructureDefinition" resource, which is a statement of rules about how the elements in a resource are used, and where extensions are used in a resource.

### Changing Cardinality

One key function of profiles is to change the cardinality of an element. A profile can restrict the cardinality of an element within the limits of the base structure it is constraining. This table summarises what that means:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| derived (across) base (down) | 0..0 (Not used) | 0..1 (optional) | 0..n (optional, many) | 1..1 (required) | 1..n (at least 1) |
| 0..1 | yes | yes | no | yes | no |
| 0..\* | yes | yes | yes | yes | yes |
| 1..1 | no | no | no | yes | no |
| 1..\* | no | no | no | yes | yes |

When a profile is constraining another profile where there are more cardinality options (e.g. low is not just 0 or 1, and high is not just 1 or \*), the same principles still apply: the constraining profile can only allow what the base profile allows.

### Limitations of Use

What Structure Definitions can do when they are constraining existing resources and datatypes is limited in some respects:

* Profiles cannot break the rules established in the base specification (e.g. cardinality as described above)
* Profiles cannot specify default values or meanings for elements
* Profiles cannot give more specific names to elements
* It must be safe to process a resource without knowing the profile

The consequence of this is that if a profile mandates extended behavior that cannot be ignored, it must also mandate the use of a [modifier extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html#modifiers). Another way of saying this is that knowledge must be explicit in the instance, not implicit in the profile.

As an example, if a profile wished to describe that a [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html) resource was being negated (e.g. asserting that it never happened), it could not simply say in the profile itself that this is what the resource means; instead, the profile must say that the resource must have an extension that represents this knowledge.

There is the facility to mark resources that they can only be safely understood by a process that is aware of and understands a set of published rules. For more information, see [Restricted Understanding of Resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#ruleset).

### Using Structure Definitions

A "constraint" Structure Definition specifies a set of restrictions on the content of a FHIR resource or data type, or an additional set of constraints on an existing profile. A given structure definition is identified by its canonical URL, which SHOULD be the URL at which it is published. The following kinds of statements can be made about how an element is used, using a series of [Element Definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html):

* Restricting the cardinality of the element. e.g. the base might allow 0..\*, and a particular application might support 1..2
* Ruling out use of an element by setting its maximum cardinality to 0
* Restricting the contents of an element to a single fixed value
* Making additional constraints on the content of nested elements within the resource (expressed as XPath statements)
* Restricting the types for an element that allows multiple types
* Requiring a typed element or the target of a resource reference to conform to another structure profile (declared in the same profile, or elsewhere)
* Specifying a binding to a different terminology value set (see below)
* Providing alternative definitions, comments/usage notes and examples for the elements defined in a Resource to explain how they are used in the context of the Profile
* Providing more specific or additional mappings (e.g. to v2 or v3) for the resource when used in a particular context
* Declaring that one or more elements in the structure must be 'supported' (see below)

Any changed definitions SHALL be restrictions that are consistent with the rules defined in the resource in the FHIR Specification from which the profile is derived. Note that some of these restrictions can be enforced by tooling (and are by the FHIR tooling), but others (e.g. alignment of changes to descriptive text) cannot be automatically enforced.

Note that structure definitions cannot 'remove' mappings and constraints that are defined in the base structure, but for purposes of clarity, they can refrain from repeating them.

A structure definition contains a linear list of [element definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html). The inherent nested structure of the elements is derived from the *path* value of each element. For instance, a sequence of the element paths like this:

* Root
* Root.childA
* Root.childA.grandchild1
* Root.childB

defines the following structure:

<Root>

<childA>

<grandChild/>

</childA>

<childB/>

</Root>

or its JSON equivalent. The structure is coherent - children are never implied, and the path statements are always in order. The element list is a linear list rather than being explicitly nested because element definitions are frequently re-used in multiple places within a single definition, and this re-use is easier with a flat structure.

### Differential vs Snapshot

Structure Definitions may contain either a differential statement, a snapshot statement or both.

Differential statements describe only the differences that they make relative to another structure definition (which is most often the base FHIR resource or data type). For example, a profile may make a single element mandatory (cardinality 1..1). In the case of a differential structure, it will contain a single element with the path of the element being made mandatory, and a cardinality statement. Nothing else is stated - all the rest of the structural information is implied (note: this implies that a differential profile can be sparse, and only mention the elements that are changed, without having to list the full structure).

Note that a differential can choose not to constrain elements. Doing so means that the profile will be more flexible in terms of compatibility with other profiles, but will require more work to support from implementing systems. Alternatively, a profile can constrain all optional elements to be not present (max cardinality = 0) - this closes the content, which makes implementation easier, but the reduces it's usefulness.

In order to properly understand a differential structure, it must be applied to the structure definition on which it is based. In order to save tools from needing to support this operation (which is computationally intensive - and impossible if the base structure is not available), a StructureDefinition can also carry a "snapshot" - a fully calculated form of the structure that is not dependent on any other structure. The FHIR project provides tools for the common platforms that can populate a snapshot from a differential (note that this tool generates complete verbose snapshots; it does not support suppressing mappings or constraints).

StructureDefinitions can contain both a differential and a snapshot view. In fact, this is the most useful form - the differential form serves the authoring process, while the snapshot serves the implementation tooling. StructureDefinition resources used in operational systems should always have the snapshot view populated.

### Slicing

One common feature of constraining Structure Definitions is to take an element that may occur more than once (e.g. in a list), and split the list into a series of sublists, each with different restrictions on the elements in the sublist with associated additional meaning. In FHIR, this operation is known as "Slicing" a list. It is common to â€œsliceâ€ a list into sub-lists each containing just one element, effectively putting constraints on each element in the list. This technique can also be used on elements that do not repeat, but that have a choice of data types.

Here is an example to illustrate the process:

In this example, the base structure definition for the resource [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html)defines the "component" element which contains a nested code and a value for observations have have multiple values. A classic example of this kind of observation is a blood pressure measurement - it contains 2 values, one for systolic, and one for diastolic ([example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-example-bloodpressure.html)).

This diagram shows the conceptual process of 'slicing' the component list into systolic and diastolic slices (note: to avoid clutter, the "name" attribute of Observation is shown as just a code not a full CodeableConcept).

The structure definition for Blood Pressure splits the component list into 2 sublists of one element each: a systolic element, and a diastolic element. Each of these elements has a fixed value for the code element (a fixed LOINC code for the name), and specifying that both have a value of type Quantity. This process is known as "slicing" and the Systolic and Diastolic elements are called "slices".

Note that when the resource is exchanged, the wire format that is exchanged is not altered by the constraining definition. This means that the item profile names defined in the structure definition ("systolic", etc. in this example) are never exchanged. A resource instance looks like this:

<Observation>

...

<component>

<code {LOINC="8480-6}"/>

<value ...>

</component>

<component>

<code {LOINC="8462-4}"/>

<value ...>

</component>

</Observation>

In order to determine that the first related item corresponds to "Systolic" in the structure definition, so that it can determine which additional constraints for a sub-list the item conforms, the system checks the values of the elements. In this case, the "name" element in the target resource can be used to determine which slice that target refers to. This element is called the â€œdiscriminatorâ€.

### Discriminator

In the general case, systems processing resources using a structure definition that slices a list can determine which slice an item in the list is to by checking whether its content meets the rules specified for the slice.

This requires for a processor to be able to check all the rules applied in the slice and to do so speculatively in a depth-first fashion. Neither of these is appropriate for an operational system, and particularly not for generated code. For this reason, a slice can nominate a set of fields that act as a "discriminator" - they are used to tell the slices apart.

When a discriminator is provided, the composite of the values of the elements nominated in the discriminator is unique and distinct for each possible slice and applications can easily determine which slice an item in a list is. The intention is that this can be done in generated code, e.g. using a switch/case statement. When slicing elements with a choice of types, the discrimnator SHALL be "@type".

When a constraining structure nominates one or more discriminators, it SHALL fix the value of the element for each discriminator for each slice (using [ElementDefinition.fixed[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-definitions.html#ElementDefinition.fixed_x_)), or if the element has a terminology binding, it SHALL be associated with a complete binding with a required [Value Set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html#required) that enumerates the list of possible codes in the value set. The structure definition SHALL ensure that there is no overlap between the set of values and/or codes in the value sets between slices. Note: At present, only a fixed value or a required value set should be used for slicing; using [ElementDefinition.pattern[x]](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-definitions.html#ElementDefinition.pattern_x_)) is not recommended as a basis for slicing while issues related to this are investigated during the DSTU period.

It is the composite (combined) values of the discriminators that are unique, not each discriminator alone. For example, a slice on a list of items that are references to other resources could nominate fields from different resources, where each resource only has one of the nominated elements, as long as they are distinct across slices.

A structure definition is not required to nominate any discriminator at all for a slice, but those that don't identify discriminators are describing content that is very difficult to process, and so this is discouraged.

Within a structure definition, a slice is defined using multiple *element* entries that share a *path* but have distinct *name*s. These entries together form a "slice group" that is:

1. **Initiated by a "slicing entry"** That is, the first *element* in a slice group must contain a *slicing* property that defines the *discriminator* for all members of the group. It also contains the unconstrained definition of the element that is sliced, potentially including children of the unconstrained element, if there are any
2. **Mutually exclusive**. This means that each *element* in a slice group SHALL describe a distinct set of values for the group's *discriminators*. Because of this constraint, an element in a resource **instance** will never match more than one *element* in a given slice group. If no discriminators are named, it SHOULD still be possible to differentiate the slices based on their properties, though it may be substantially harder to do so
3. **Serialized as a group**. The entries in a slice group must be **adjacent** in a serialized structure definition, **or**, if there are any intervening elements, those elements must be "compatible with" the group. Concretely, this means that any intervening elements must have a *path* that starts with the slice groups's *path*. For example, an *element* with a *path* of *Observation.name.extension* would be compatible with (and thus, would not "break up") a slice group whose path was *Observation.name*

The value of the discriminator element is a path name that identifies the descendant element using a dotted notation. For references, the path transitions smoothly across the reference and into the children of the root element/object of the resource. For extensions, an extension can be qualified with the URL of the extensions being referred to. There are two special names: @type, and @profile. Here are some example discriminators:

|  |  |  |
| --- | --- | --- |
| **Context** | **Discriminator** | **Interpretation** |
| List.entry | item.reference.name | Entries are differentiated by the name element on the target resource - probably an observation, which could be determined by other information in the profile |
| List.entry | item.reference.@type | Entries are differentiated by the type of the target element that the reference points to |
| List.entry | item.reference.@profile | Entries are differentiated by a profile tag on the target of the reference, as specified by a structure definition (todo: how to do that?) |
| List.entry | item.extension["http://acme.org/extensions/test"].code | Entries are differentiated by the value of the code element in the extension with the nominated URL |
| List.entry.extension | url | Extensions are differentiated by the value of their url property (usually how extensions are sliced) |
| List.entry | item.reference.@type, item.reference.name | Extensions are differentiated by the combination of item.reference.name, and, if it has one, the name element. This would be appropriate for where a List might be composed of a Condition, and set of observations, each differentiated by its name - the condition has no name, so that is evaluated as a null in the discriminator set |
| Observation.value[x] | @type | Different constraints (e.g. "must support", usage notes, vocabulary bindings, etc.) are asserted for different supported types for the multi-typed element Observation.valu |

The [examples of slicing and discriminators](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling-examples.html) show exactly how this and other typical uses of slicing are represented in profiles.

### Re-slicing

When creating a profile based on another profile, it's sometimes necessary to slice data that has already been sliced in the base profile. This is called "Re-slicing". The rules for re-slicing are as follows:

When you slice, you define a name for each new slice. The name has to be unique across the set of slices in the profile. So if profile A defines an element X with cardinality 0..\*, and profile B is derived from profile A, then profile B can either:

1. make a constraint on X with no name - in which case the profile is constraining all appearances of X; or
2. make a constraint on X with a name - in which case the profile is describing a specific slice on X, and the constraints only apply to that slice; or
3. it can do both

Then, profile C derives from profile B. Profile C can do the following:

1. make a constraint on X with no name - in which case the profile is constraining all appearances of X; or
2. make a constraint on X with a different name from that used in profile B - in which case the profile is describing a specific new slice on X, and the constraints only apply to that slice; or
3. make a constraint on X with the same name as that used in profile B - in which case the profile is making new constraints on the slice defined in profile B; or
4. some combination of the above options

Note: it is possible for Profile C to make rules that are incompatible with profile B, in which case there is no set of instances that can be valid against profile C

In addition to the above, there are times when Profile C will need to further slice a slice defined in B. In this case, there's a need to reference both the name of the original slice from Profile B as well as to define a name for the slice defined within Profile C. This is done by separating the names using "/". For example, if Profile B defines the slice "example", and profile C defines the slice "example/example1", then this is deemed to be "example1" slice of the example slice. This process can continue indefinitely by separating each layer of slicing names with the "/" character.

### Extension Definitions

An extension definition defines the url that identifies the extension and which is used to refers to the extension definition when it is used in a resource.

The extension definition also defines the context where the extension can be used (usually a particular path or a data type) and then defines the extension element using the same details used to profile the structural elements that are part of resources. This means that a single extension can be defined once and used on different Resource and/or datatypes, e.g. one would only have to define an extension for â€œhair colorâ€ once, and then specify it can be used on both Patient and Practitioner.

For further discussion of defining and using extensions, along with some examples, see [Extensibility](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html).

#### Using Extensions in Profiles

Once defined, an extension can be used in an instance of a resource without any Profile declaring that it can, should or must be, but Profiles can be used to describe how an extension is used.

To actually prescribe the use of an extension in an instance, the extension list on the resource needs to be sliced. This is shown in [the extensibility examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility-examples.html#sliceextensions)

Note that the minimum cardinality of an extension SHALL be a valid restriction on the minimum cardinality in the definition of the extension. if the minimum cardinality of the extension is 1 when it is defined, it can only be mandatory when it is added to a profile. This is not recommended - the minimum cardinality of an extension should usually be 0.

### Binding Definitions

Coded elements have bindings that link from the element to a definition of the set of possible codes the element may contain. The binding identifies the definition of the set of possible codes and controls how tightly the set of the possible codes is interpreted.

The set of possible codes is either a formal reference to a [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) resource, which may be version specific, or a general reference to some web content that defines a set of codes. The second is most appropriate where a set of values is defined by some external standard (such as mime types). Alternatively, where the binding is incomplete (e.g. under development) just a text description of the possible codes can be provided.

Bindings have a property that defines how the strongly implementations are required to use the set of codes. See [Binding Strength](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#strength).

### Mixing Custom and Standard Terminologies

[Value Set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) resources can be used to carry definitions of local code systems ([Example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-example-inline.html)) and to mix a combination of local codes and standard codes (e.g. LOINC, SNOMED), or just to choose a particular set of standard codes (examples: LOINC, SNOMED, RxNorm). Profiles can bind to these value sets instead of the ones defined in the base specification, following these rules:

|  |  |
| --- | --- |
| [**Binding Strength**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#binding) **in base specification** | **Customization Rules in Profiles** |
| required | The value set can only contain codes contained in the value set specified by the FHIR specification |
| extensible | The value set can contain codes not found in the base value set. These additional codes SHOULD NOT have the same meaning as existing codes in the base value set |
| preferred | The value set can contain whatever is appropriate for local use |
| example | The value set can contain whatever is appropriate for local use |

Note that local codes are not as interoperable as standard published code systems (e.g. LOINC, SNOMED C, so it is preferable to use standard code systems.

### Changing Binding Strength in Profiles

A profile can change the terminology binding of an element - both strength and value set - within the limits of the base structure it is constraining. This table summarises the changes that can be made to the binding strength:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| derived (across) base (down) | required | extensible | preferred | example |
| required | yes | no | no | no |
| extensible | yes | yes | no | no |
| preferred | yes | yes | yes | no |
| example | yes | yes | yes | yes |

Note that a constraining profile may leave the binding strength the same and change the value set instead. Whatever the constraining profile does, it cannot make codes valid that are valid in the base structure/profile.

### Must Support

One property that can be declared on profiles that is not declared on the resource or data type definitions is "Must Support". This is a boolean property. If true, it means that systems claiming to conform to a given profile must "support" the element. This is distinct from cardinality. It is possible to have an element with a minimum cardinality of "0", but still expect systems to support the element.

The meaning of "support" is not defined by the base FHIR specification, but can be set to true in a profile. When a profile does this, it SHALL also make clear exactly what kind of "support" is required. Examples might include:

* The system must be able to store and retrieve the element
* The system must display the element to the user and/or allow the user to capture the element via the UI
* The element must appear in an output report
* The element must be taken into account when performing decision support, calculations or other processing
* etc.

The specific meaning of "Must Support" for the purposes of a particular profile SHALL be described in the element.definition, the general StructureDefinition.description or in other documentation for the implementation guide the profile is part of.

If creating a profile based on another profile, Must Support can be changed from false to true, but cannot be changed from true to false. Note that an element that has the property IsModifier is not necessarily a "key" element (e.g. one of the important elements to make use of the resource), nor is it automatically mustSupport - however both of these things are more likely to be true for IsModifier elements than for other elements.

### Search Criteria

The final thing implementations can do is to define search criteria in addition to those defined in the specification itself. Search criteria fall into one of four categories:

1. Enabling search on core elements that don't have standard search criteria defined (e.g. searching Observation by normal range)
2. Enabling search on elements that already have a standard search criteria defined, but with custom matching rules. E.g. a sounds-like search on Practitioner name
3. Enabling search on a particular extension
4. Enabling search that doesn't correspond to a single element but rather a combination of elements or computation on an element. E.g. searching for patients by age

Additional Search Parameters can be defined using the [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) resource.

### Supporting Multiple Profiles

Applications may be required to support more than one profile at a time. A typical example might be an EHR application that is required to support a general purpose data sharing profile (such as [DAF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html)), and also must support specific profiles for decision support using the same interface.

The impact of supporting two sets of profiles depends on whether resources are being created or consumed. When an application is creating content, it has to create content that conforms to both sets of profiles - that is, the intersection of the profiles. When an application is consuming information, then it must be able to consume content that conforms to either set of profiles - that is, the union of the profiles.

Since applications generally consume and produce resources at the same time, conforming to more than one profile may not be possible, unless the profiles are designed to make statements at different levels - and the case above is one such case, where one profile is focused on data access, provenance, and availability, while one profile is focused on clinical content.

Accordingly, profiles can relate to each other in 4 different ways. Each profile can be thought of in terms of the set of instances that conform to the profile:

1. non-overlapping: there no instances that conform to profiles A & B (technically, the intersection of profiles A & B is an empty set)
2. partly overlapping: some instances conform to both A & B, but others only conform to A or B
3. one set contained in the other: all resources that conform to A conform to B, but only some of the ones that conform to B conform to A (or vice versa)
4. identical sets: all resources that conform to A also conform to B and any resources that don't conform to B, don't conform to A

Profiles can be compared to determine their compatibility. One [such comparison](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf-cqi.html) can be found between [DAF](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\daf\daf.html) and [QICore](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\qicore\qicore.html). Note that this comparison is generated by tooling under ongoing development, and is purely draft content to demonstrate the idea of profile copmarison.

# pushpull.html

## Managing Push and Pull

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The primary focus of FHIR is exchanging healthcare data between systems. Whenever one system has information that another needs or wants, one question that automatically arises is whether the source system will push the data, or whether the destination system will pull the data.

|  |  |
| --- | --- |
| Push | As new information becomes available, the source system sends the information to the destination. It expects the destination system to maintain and index the information on receipt. The source system must trust the destination system to manage access/security appropriately |
| Pull | The source system maintains and indexes data. When the destination system wants or needs the information, it must retrieve it form the source system. Either the source or the destination (or both) manages access/security |

Note that it is possible to mix these modes by adding an interface repository into the mix. For example, to connect a push-based source with a pull-based destination, simply have the source push information at the repository, and the destination can pull data from it as required. If the source is pull based, the interface repository can query it for new data on a regular basis, and when it finds any, it can push it at the destination.

Which combination of push, pull and interface repositories is appropriate for any given context depends on a host of factors around deployment architecture, network and business topology, security policies, etc. However, it is often constrained by the capabilities of the various systems and the standards used in the exchange.

The FHIR specification supports and enables both push and pull:

* **REST**: The REST API can be used in either fashion - this is discussed in more depth below
* **Messages**: FHIR defines message events for both push and pull
* **Services**: Services may be defined to support either model
* **Documents**: This question doesn't apply, because documents are bundles that are exchanged using either REST, messages, or services

### Push and Pull on a RESTful interface

* Push: The source is a client, and when new data is available, it uses [create](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#create), [update](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#update), and [transaction](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#transaction) to push data to the destination, which is a server
* Pull: The source is a server, and the destination is a client. When the client wants to use the data, it uses a combination of [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) and [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) so the users can find the data they need
* Push/Pull: The source is a server, and the destination is a client. On a regular basis, the destination queries the server for its [history](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#history), and replicates the changes in its own copy of the database

# qa.html

# FHIR QA Report

# rdf.html

## RDF Representation

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 1 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [Draft](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page and the RDF forms are particularly prone to change. The page is not part of the current ballot, and so at the most it can be a draft page in DSTU 2. Comments on this and the page content are welcome.

FHIR resources can be represented as an [RDF graph](http://www.w3.org/RDF/) serialised in one of a number of RDF syntaxes. When represented in RDF, the resources are described as instances of classes that are also defined in RDF, and published with this specification. This page describes:

* [RDF description of the FHIR Resource Class definitions](#class)
* [RDF representation of Profiles](#profile)
* [RDF description of FHIR resource instances](#instance)
* [How to exchange RDF using the RESTful API](#api)

Note: this page uses turtle for clarify and readability, but there is no requirement or expectation that turtle should be used in preference to other syntaxes. Note that production turtle instances would not be laid out so clearly either.

Implementer Note: The FHIR RDF format is defined to assist the process of bridging between operational data exchange and formal knowledge processing systems. While the RDF form offers a fully functional representation of FHIR resources, it has very different operational characteristics from the [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\json.html) and [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xml.html), and would be implemented for different reasons. Systems focused on operational exchange of data would not generally use RDF.

### RDF Representation of FHIR

The FHIR RDF definitions are defined for the following purposes:

* Providing the class definitions to support RDF based representation of resource instances
* Supporting knowledge based analysis of the FHIR specification itself
* Providing knowledge of use at run-time for converting between FHIR and other content models
* Supporting reasoning across the information/terminology model boundary

The RDF definitions are published as a series of turtle files [RIM](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rim.ttl) and [FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir.ttl).

#### RDF Class Definitions

The backbone of the RDF definitions are a formal definition of the FHIR resources as RDF classes. Each data type, resource, or element within a resource is defined as rdf:Class with a series of rdf:Property items. Each property has a rdfs:range the specifies the value domain for the property. In most cases, the conversion from the base resource definitions is straight-forward.

Constraints are represented intwo ways - as OWL statements, and as SHACL predicates. Implementers wishing to enforce constraints can use tools from either language, or process the knowledge represented in these constraints in any other way they see fit.

#### Enumerated Codes

FHIR elements that have a [code data type](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) with a [Required](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html#required) binding to an extensional [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) are bound directly to the concepts defined in the code system. The RDF defines the value set, an associated code system, and an RDF class for the code system. Each code in the code system is defined as a singleton class where the class elucidates the definition and relationships of the concept, and the single instance is used to refer to the concept.

#### The Ontological RIM

THe RDF definitions for the resources and classes are also mapped to an ontological representation of the v3 RIM, which is also distributed as part of this specification ([turtle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rim.ttl) and [RDF/XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rim.rdf.xml)). The resources and type definitions refer to both classes and code systems defined as part of the RIM. The references to the classes defined in the RIM are generally only of interest from a RIM perspective; they do not define semantics that are necessary to understand the FHIR resources directly.

The Ontological RIM is a variant of the [v3 RIM](http://www.hl7.org/implement/standards/rim.cfm) optimised for its use as an ontology supporting FHIR and other reasonsing uses. It has the following variations from the classical v3 RIM:

* II.root and CD.codeSystem are changed to xs:anyUri so that they can accomodate RDF concepts as well as pure OIDs and UUIDs
* The structure of the CD data type has been re-organised to support validation logic more effectively
* Only the base structural classes are included (yet?)
* More: mixins? associations? nullFlavor on associations?

#### Other Mappings

In addition to mappings to the Ontological RIM, the RDF contains mappings to other sources of knowledge, including LOINC, SNOMED CT, OBO, etc. In these cases, the mappings reference concepts that are not defined within the RDF content provided as part of this specification, and implementers will need to locate them elsewhere.

### Decimal Precision

todo.

### RDF Representation of Profiles

todo.

### RDF Resource Instances

A FHIR resource is represented by a series of RDF triples, starting with the fixed identifier ":resource". For readability, this page presents instances using turtle, but production instances can use any valid RDF syntax.

@prefix fhir: <http://hl7.org/fhir/> .

@prefix flag: <http://hl7.org/fhir/Flag.> .

:resource a fhir:Flag;...

The ":resource" object has a type predicate ("a") the indicates what kind of resource it is. In addition, the object will have a series of predicates for the properties defined in the RDF class definitions:

:resource a fhir:Flag;

flag:id "example";

flag:text [...];

flag:category [...];

flag:status fhir:flag-status\#active.

Enumerated fields are represented using a anonymous concept that has an rdf:type which is the concept as defined in the RDF code system definitions.

Property names are defined by class, and follow into the data types:

flag:category [

fhir:CodeableConcept.coding [

fhir:Coding.system <http://example.org/local>;

fhir:Coding.code "admin";

fhir:Coding.display "Admin";

];

fhir:CodeableConcept.text "admin"

];

The [primitive types](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html) are represented using the same W3C schema based types as in the XML and JSON formats. Since the types are defined in advance, there is not usually a need to specify the type explicitly unless the RDF syntax requires this (e.g. in turtle, it would not be specified).

There are several special issues for the RDF based representation:

#### Missing elements

There are a number of elements in the FHIR resources and data types that have an explicit meaning or a default value when they are missing. Default values are represented explicitly in the RDF representation; they are omitted. For example, Patient.active has a default value of "false", and is defined like this:

fhir:Patient.active a rdf:Property;

os:occurs os:Zero-or-one;

rdfs:range fhir:boolean;

fhir:default [

a fhir:boolean;

fhir:value [ fhir:Boolean.value "true"]

].

Since it has a default value, it can never be omitted from an instance:

:resource a fhir:Patient;

fhir:Patient.active [ fhir:Boolean.value "true"],

...etc

Some elements do not have a default value, but they do have a meaning when there is no element present. As an example, if [Patient.animal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient-definitions.html#Patient.animal) is not present, the the patient is a human. In RDF (OWL particularly), reasoners cannot infer meaning from missing elements, so the element must always be present, but may have a value of http://hl7.org/fhir/nil (in RDF, fhir:nil).

Here's a patient resource with an animal property:

:resource a fhir:Patient;

pat:animal [ ... ]

If the patient is human then the representation will be:

:resource a fhir:Patient;

pat:animal fhir:nil;

Note: fhir:nil may be used for any property that has no value in a JSON or XML instance, but when the element has a 'meaning when missing', there SHALL be either a value of fhir:nil in the instance.

#### Order

FHIR elements with cardinality > 1 are inherently ordered (though the meaning of the order may not be known, or the order may have no real significance). This order must be maintained when round-tripping FHIR instances.

TODO: it is not yet resolved how this will be done.

#### Contained Resources

Contained resources are represented like this:

:resource a fhir:Observation;

fhir:contained :resource\#23;

fhir:Observation.subject [

fhir:Reference.reference [ fhir:string.value :resource\#23]

].

:resource\#23 a fhir:Patient;

fhir:Patient.name [

fhir:text [ fhir:string.value "John Smith"]

].

In order to make it easy to serialise multiple resources, the id within the resource is scoped by the URL of the resource that contains it.

#### Extensions

In RDF, extensions are represented in two parts. The first part is a definition of the resource, and the second part is the extension value. Extensions are split like this in RDF to take advantage of RDF and to make reasoning easier.

The first part is the definition. This conveys whether the extension is a modifier, and what type it has:

@prefix ex: <http://hl7.org/fhir/StructureDefinition/> .

ex:birthplace a fhir:ExtensionDefinition;

rdfs:range fhir:Address;

fhir:flag fhir:isModifier.

This definition SHALL be present in any instance of an RDF graph where an extension is used. If the extension is a modifier, it SHALL be labelled as such. Additional information from the extension definition MAY be provided, but this is not required, and often is not possible (the minimum mandatory content is also represented in XML and JSON).

The value of an extension is represented as a predicate:

:resource a fhir:Patient;

ex:birthPlace [ .. properties of address ... ];

The value of the property is the value of the extension, or a complex object with further extensions.

#### Concept References

The data type [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) and its container [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept) represent references from a resource to a separate knowledge container. The definitions of the Coding data type is constained by operational considerations around incomplete knowledge, longitudinal version issues, use across multiple contexts, etc, so a mapping process is required to match the information that constitutes the Coding reference to the target RDF concept on which reasoning will be based.

For instance, a reference to a LOINC code in an JSON resource instance takes this form:

{

"resourceType" : "Observation",

"code" : {

"coding" : {

"system" : [ fhir:uri.value "http://loinc.org"],

"code" : [ fhir:code.value "54411-4"],

"display" : [ fhir:string.value "Rh immune globulin given Qualitative"]

},

"text" : "Rh immune globulin"

}

}

As an example, in the local LOINC RDF representation, the URI for that LOINC code is http://loinc.org/owl/54411-4. (Note that for many terminologies, including LOINC, there is no standard RDF representation and multiple forms with different addressing schemes are available. Where standard representations exist, implementers SHOULD use the same addressing scheme.)

There is no algorithmic conversion between the system/code and the equivalent RDF concept; instead, a mapping table or process of some kind must be maintained. These mapping tables have variable complexity. In the worst case - codes that have the form of an expression - considerable syntactic and semantic logic is required to perform the mapping. For this reason, the reconciliation process is often performed as a preprocessing step prior to using the RDF for reasoning. Once the reconciliation process is complete, the resolved concepts are stated as rdf:type assertions on the concept:

@prefix loinc: <http://loinc.org/owl#> .

:resource a fhir:Observation;

fhir:Observation.code [

a loinc:54411-4;

fhir:CodeableConcept.coding [

fhir:Coding.system [ fhir:uri.value <http://loinc.org>] ;

fhir:Coding.code [ fhir:code.value "54411-4" ];

fhir:Coding.display [ fhir:string.value "Rh immune globulin given Qualitative"];

];

fhir:CodeableConcept.text [ fhir:string.value "Rh immune globulin" ];

].

Typically, these type assertions are only used in the RDF form, but they can be carried as a normal FHIR extension in both the XML and JSON forms:

{

"resourceType" : "Observation",

"code" : {

"extension" : {

"url" : "http://hl7.org/fhir/StructureDefinition/rdftype",

"valueUri" : "http://loinc.org/owl/54411-4"

},

"coding" : {

"system" : "http://loinc.org",

"code" : "54411-4",

"display" : "Rh immune globulin given Qualitative"

},

"text" : "Rh immune globulin"

}

}

Implementers should note that these type assertions often reference local ontologies, and the correct URI may be scope dependent or may vary on a different lifecycle to the coding information itself, and so it is usually not appropriate to persist these references.

These type assertions may be made against either CodeableConcept or Coding data types; when the FHIR resource property has a type of CodeableConcept they should be made at this level rather than on the Coding.

#### Resource References

The [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference) data type represents a reference from a resource to to another. The reference may be a relative URL, and resolution is subject to local rules and context (e.g. server API [base], or context in a bundle). For the same reasons as with Concept References, this can be reconciled with the actual concrete resource instance in the RDF. As an example, a reference to a resource would be represented like this in JSON:

{

"resourceType" : "Observation",

"subject" : {

"reference" : "Patient/example"

}

}

In RDF, this is represented as a an anonymous instance of the data type reference:

:resource a fhir:Observation;

fhir:Observation.subject [

fhir:Reference.reference [ fhir:string.value "Patient/example" ];

a pat:example

].

If this has been resolved to a specific instance, then the subject is directly assigned to the instance:

:resource a fhir:Observation;

fhir:Observation.subject :patient-example.

:patient-example fhir:Reference.reference [ fhir:string.value "Patient/example" ];

The details of the reference are added to the target resource. *TODO: this means that traceability of the reference is lost, and it's not round-trippable if the reconciliation includes resources that have more one literal value to reference the target resource*

@prefix pat: <http://acme.com/services/fhir/Patient/#>

:resource a fhir:Observation;

fhir:Observation.subject [

fhir:Reference.reference [ fhir:string.value "Patient/example" ];

a pat:example

].

#### Other Stuff

Todo: implement a template for RDF? (turtle? RDF XML - yuck) Todo: note that there's no canonical form for RDF, nor any defined support for signatures.

### Using RDF with the REST API

When using RDF on the REST API, the following media types apply:

* text/turtle - RDF as Turtle
* application/rdf+xml - RDF in XML format
* text/n3 - N3 format

Implementations are encouraged to support this list. However servers are not required to support all these, and may support additional syntaxes.

# redirect.html

See here: [this link](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\site\index.html).

# references-definitions.html

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

# references.html

## Resource References

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Many of the defined elements in a resource are references to other resources. Using these references, the resources combine to build a web of information about healthcare.

Resources contain two types of references:

* **Internal "contained" references** - references to other resources packaged inside the source resource
* **External references** - references to resources found elsewhere

References are always defined and represented in one particular direction - from one resource (source) to another (target). References are provided as a URL, which may either be absolute or relative. Resolving the references is discussed below.

The corresponding reverse relationship from the target to the source exists in a logical sense, but is not represented explicitly in the resource. For external references, navigating these reverse relationships requires some external infrastructure to track the relationship between resources (the [REST API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) provides one such infrastructure by providing the ability to [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) the reverse relationship by naming search parameters for the references, and by providing support for [reverse includes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#revinclude)).

Because resources are processed independently, relationships are not considered to be transitive. For example, if a [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) resource references a particular [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) as its subject, and references a [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html) resource as its cause, there is no automatic rule or implication that the procedure has the same patient for its subject. Instead, the subject of the procedure must be established directly in the procedure itself. Another way to state this is that the context of the subject is not "inherited", nor does it "conduct" along the relationship to procedure. The only exception to this is the case of contained resources (see below). Note that in practice, the relationships do need to describe a logical and coherent record, and in the case of the Condition and Procedure described here, they would usually be required to have the same patient for their subjects.

In a resource, references are represented with a reference and a text description. The *reference* is the key element - resources are identified and addressed by their URL. The actual reference looks like this:

**Constraints**

Notes:

* The *reference* element contains a url that is either
  + an absolute URL
  + a relative URL, which is relative to the [Service Base URL](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#root), or, in a bundle the Bundle.entry.fullUrl (see [Resolving References in Bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html#references)
  + an internal fragment reference (see "Contained Resources" below)
* Using absolute URLs provides a stable scalable approach suitable for a cloud/web context, while using relative/logical references provides a flexible approach suitable for use when trading across closed ecosystem boundaries. (see [implementation issues for further discussion](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementation.html#identity))
* Absolute URLs do not need to point to a [FHIR RESTful server](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), though this is the preferred approach. Whether or not the reference is to a FHIR RESTful server, the reference SHALL point to a Resource as defined by this specification.   
  Note: This regex is true if the reference to a resource is consistent with a FHIR API:
* ((http|https)://([A-Za-z0-9\\\/\.\:\%\$])\*)?()\/(\/\_history\/)?

However conformance with this regex is no guarantee that the end point is a FHIR server

* URLs are always considered to be case-sensitive
* The *display*, if populated, does generally not have identical content to the Resource.text of the referenced resource. The purpose is to identify what's being referenced, not to more fully describe it

A relative reference to the [patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) "034AB16" in an element named "context" on a FHIR RESTful server:

<context>

<reference value="Patient/034AB16" />

</context>

An absolute reference to a [Structure Definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) in an element named "profile":

<profile>

<reference value="http://fhir.hl7.org/svc/StructureDefinition/c8973a22-2b5b-4e76-9c66-00639c99e61b" />

</profile>

*Note that HL7 has not yet actually created a profile registry, nor decided on a URL for it*.

A short display text that provides a human-readable identification of the resource may be provided:

<custodian>

<reference value="Organization/123" />

<display value="HL7, Inc" />

</custodian>

This text can be used by a system that is unable to resolve the reference to an actual resource.

Note that some elements have the type "[uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri)" instead of "Reference". URIs may point to either resources, elements inside a resource by their "id" property, or (most often) some other content that is not a resource. The Reference type is only used to refer to resources directly, by their logical id.

### Contained Resources

In some circumstances, the content referred to in the resource reference does not have an independent existence apart from the resource that contains it - it cannot be identified independently, and nor can it have its own independent transaction scope. Typically, such circumstances arise where resources are being assembled by a secondary user of the source data, such as a middleware engine. If the data available when the resource is constructed does not include record keys or absolute identification information, then a properly identified resource cannot be assembled, and even if an arbitrary identification was associated with it, the resource could never be the subject of a transaction outside the context of the resource that refers to it.

For example, consider a situation where an interface engine is creating a [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) record on a patient from an HL7 v2 message, and the only information about the primary surgeon is her first name and lastname (REL-7.2 & RES-7.3). In the absence of a controlled practitioner directory, this is not enough information to create an identified [Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html) resource - more than one practitioner might have the same name.

In these circumstances, the resource is placed directly in line in the resource. **This SHOULD NOT be done when the content can be identified properly, as once the identification is lost, it is extremely difficult (and context dependent) to restore it again.**

An example of a contained resource:

<Composition xmlns="http://hl7.org/fhir">

<extension>...</extension>

<text>...</text>

<contained>

<Organization>

<id value="org1"/>

<!-- whatever information is available -->

</Organization>

</contained>

<information>

<!-- other attributes -->

<custodian>

<reference value="#org1" />

</custodian>

<!-- other attributes -->

<information>

</Composition>

The same example in JSON:

{ "resourceType" : "Composition",

"extension" : { ... },

"text" : { .. },

"contained: [

{

"resourceType" : "Organization",

"id" : "org1",

.. whatever information is available ...

} ]

"information: {

... other attributes ...

"custodian" : {

"reference" : "#org1"

}

... other attributes ...

}

}

Design Note: Contained resources are still a reference rather than being inlined directly into the element that is the reference (e.g. "custodian" above) to ensure that a single approach to resolving resource references can be used. Though direct containment would seem simpler, it would still be necessary to support internal references where the same contained resource is referenced more than once. In the end, all that it would achieve is creating additional options in the syntax. For users using XPath to process the resource, the following XPath fragment resolves the internal reference:

ancestor::f:\*[not(parent::f:\*)]/f:contained/\*[@id=substring-after(**current()**/f:reference/@value, '#')]

Some notes about use and interpretation of contained resources:

* The "contained" element SHALL NOT have extensions on it (though contained resources can still contain extensions)
* Contained resources share the same internal id resolution space as the parent resource (for id attributes, see below)
* Contained resources SHALL NOT contain additional contained resources
* Contained resources SHALL NOT contain any narrative
* A contained resource SHALL only be included in a resource if something that resource has a reference to it

Resources that are contained inline do not "inherit" context from their parent resource. For instance, if the parent resource contains a "subject", and the contained resource also has a "subject" element defined, there is no implication that the contained resource has the same subject as the parent resource.

Resources can only be contained in other resources if there is a reference from the resource to the contained resource. This is intended to ensure that the meaning of the contained resource is clear, and that there is no confusion as to its significance.

**DSTU Note:** There are some identified use cases where it would be useful to include resources that refer to the contained resource rather than the container referring to the contained resource, but this has a series of structural ramifications for the API. Whether these can be resolved is an open issue for investigation during the period of trial use.

Feedback is welcome [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

# resource-definitions.html

## Resource Definitions - Detailed Descriptions

### Resource

### Reference

# resourceguide.html

## Guide to resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [Draft](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The FHIR specification defines a set of resources, and an infrastructure for handling resources. In order to use FHIR to create solutions for integration requirements, implementers must map their problems to resources and their content.

The resources are classified into 6 sections:

1. [**Clinical**](#clinical): The content of a clinical record
2. [**Identification**](#identification): Supporting entities involved in the care process
3. [**Workflow**](#workflow): Manage the healthcare process
4. [**Financial**](#financial): Resources that support the billing and payment parts of FHIR
5. [**Conformance**](#conformance): Resources use to manage specification, development and testing of FHIR solutions
6. [**Infrastructure**](#infrastructure): General functionality, and resources for internal FHIR requirements

This page describes the resources and their functional intent in more detail to assist implementers to understand their purpose and scope, and their supporting classifications.

Where to find common concepts in this specification:

|  |  |  |
| --- | --- | --- |
| **Concept** | **Example** | **Where to find** |
| **Clinical Findings** | | |
| Laboratory Results | Blood panels such as CBC with Differential, Liver Panel, etc) | [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) with [Observations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) |
| Imaging Study Findings | CT Scans, MRI, Plain Radiographs, Ultrasounds) | [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) (some with [Observations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html)) |
| Diagnostic Test Results | EKG, pulmonary function test, EEG) | [Observations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) (and maybe a [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html)) |
| Vital Signs | Temperature, Blood Pressure, Heart Rate, Respiratory Rate) | [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) |
| Other Physical Exam Findings | Auscultation findings) | [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) |
| Pulmonary Artery Catheter readings | Pulmonary artery pressure) | [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) |
| **Patient Problems, Allergies and Adverse Events** | | |
| Allergy | Food or drug allergies | [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) |
| Clinical Diagnosis | Diabetes, Congestive Heart Failure | [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) |
| Adverse Event / Reaction | Adverse reaction to an agent, falls, adverse surgical events, hospital infections | (not done yet) |
| **Patient History** | | |
| Chief Complaint | Cough, Pain, Fever, Fatigue | [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) |
| Past Surgical History | Appendectomy, Hernia repair | [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html) |
| Past Medical History | Diabetes, Congestive heart failure | [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) |
| MAR (Medication Administration Record) | Warfarin 5mg PO administered on 12/10/2013 at 3pm | [MedicationAdministration](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationadministration.html) |
| Home Meds | Warfarin 5mg, 30 day supply, dispensed on 12/01/2013 | [MedicationStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationstatement.html) |
| Social History | Sexual behavior, Smoking status, Alcohol intake, Illicit drug use | [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) |
| Family History | Mother has diabetes | [FamilyMemberHistory](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\familymemberhistory.html) |
| Signs & Symptoms | from a review of systems- Pain, Fever | [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) |
| **Suggested Physician Orders** | | |
| Proposal for a laboratory test | A blood panel, a stool analysis | [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) |
| Proposal for an imaging procedure | CT Scan, MRI, X-Rays | [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) |
| Proposed Diet Order | An oral diet order | [NutritionOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\nutritionorder.html) |
| Proposed respiratory order | Oxygen delivery | Not done yet |
| Proposed Medications | Aspirin, Lisinopril | [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) |
| Proposed Supply | Wheel Chair, Food Tray | [SupplyRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\supplyrequest.html) |
| **Interdisciplinary Care Planning** | | |
| Patient Goal | Reduce risk of falls, lose weight | [Goal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\goal.html) (as part of a [CarePlan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html)) |
| Intervention | Patient assessments | [ProcedureRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedurerequest.html) |

In addition, to the information on this page, see also [Common Use Cases](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\usecases.html).

### Resource Classification

In addition to the overall classification above, Resources and the data elements in them are tapped into an overall ontology that provides consistent meaning across the resources.

One of the most fundamental aspects of a resource is tense - where it fits into the time line. Some resources are records of past events, some are plans for the future, etc. This table summarises the categories:

|  |  |
| --- | --- |
| **Type** | **Description** |
| Past | A record of an event that has happened |
| Present | A record that serves an exchange in real time |
| Future | A record that describes a future intent |
| Ongoing | A record that is maintained over time that tracks the state of a patient |
| Unrelated | A record that doesn't relate to time (e.g. a fixed entity) |

Note that even future records end up in the past after the event they are concerned with passes.

### Clinical

#### General

AllergyIntolerance, Condition, and Procedure are common resources that appear throughout the patient record - summaries of the patient status or history. FamilyMemberHistory tracks significant health issues for relatives of the patient, since these are signficant risk factors for the patient. These resources may be found in patient, episode, and discharge summaries, and consultation records.

ClinicalImpression (aka ClinicalAssessment) records the core of a clinical consultation/assessment/impression. When an single text note is inserted directly in the patient record, this is typically a ClinicalImpression.summary. A RiskAssessment is an assessment - usually, but not necessarily, by a decision support engine of the likely outcomes of some course of action for a patient.

A DetectedIssue is an active alert that there is a clinical issue with/between one or more active or proposed clinical actions for a patient. One way it may be used is as part of an error message in response to an attepted operation.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [AllergyIntolerance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\allergyintolerance.html) | [Ongoing](#ongoing) | Act | This has a [Current List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current) |
| [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) | [Ongoing](#ongoing) | Act | This has a [Current List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current) |
| [Procedure](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedure.html) | [Past](#past) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [FamilyMemberHistory](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\familymemberhistory.html) | [Past](#past) | Act |  |
| [ClinicalImpression](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinicalimpression.html) | [Past](#past) | Act |  |
| [RiskAssessment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\riskassessment.html) | [Present](#present) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [DetectedIssue](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\detectedissue.html) | [Present](#present) | Act |  |

#### Care Provision

These resources support planning of care provision - care and treatment plans.

CarePlan and Goal are the primary structures around which future planning for the patient is based. These are used to define future planned care for a patient, and may be updated and adjusted as ongoing care is provided.

ReferralRequest is the basis for a proposed/requested transfer of care from one clinician to another. Typically, these are associated with a transfer of records, and a physical relocation of the patient, but neither of these are required. A ProcedureRequest records a request for a procedure to be carried out.

NutritionOrder is a request to supply a diet, formula feeding (enteral) or oral nutritional supplement to a patient and VisionPrescription contains the details of visual aids requested for a patient.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [CarePlan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html) | [Ongoing](#ongoing) | Act |  |
| [Goal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\goal.html) | [Future](#future) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [ReferralRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\referralrequest.html) | [Future](#future) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [ProcedureRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\procedurerequest.html) | [Future](#future) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [NutritionOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\nutritionorder.html) | [Future](#future)/[Ongoing](#ongoing) | Act |  |
| [VisionPrescription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\visionprescription.html) | [Future](#future) | Act |  |

#### Medication Management

Supports the medication and immunization processes. Some points of note:

* Prescription = a MedicationOrder
* In some records, medication orders, administration, and statements may not be well differentiated. Generally, use MedicationStatement if records are unclear
* A medication chart (or variants) will use multiple different types of medication resources
* When prescribing is done by external code systems (e.g. most ambulatory prescribing), the Medication resource is not used; it is generally used for formulary and custom formulations

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Medication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication.html) | [Unrelated](#unrelated) | Role |  |
| [Medication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medication.html) | [Medication](#medication) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [MedicationDispense](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationdispense.html) | [Past](#past) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [MedicationOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) | [Future](#future) | Act | [Request/Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#order). This has a [current List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current) |
| [MedicationStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationstatement.html) | [Ongoing](#ongoing) / [Past](#past) | Act | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity). This has a [Current List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current) |
| [Immunization](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\immunization.html) | [Past](#past) | Act |  |
| [ImmunizationRecommendation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\immunizationrecommendation.html) | [Future](#future) | Act |  |

#### Diagnostics

Resources concerned with observing the patient, and the diagnostic service process built around this. The Observation resource is a widely used general purpose tool. Typical uses include recording the following kinds of data:

* Laboratory Results
* Vital Signs (including Blood Pressure)
* Physical Examinations
* Social history (e.g. Smoking History)

and many more things beside. Note that 'everything is an observation', but implementations should not use Observation where [Condition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\condition.html) is more appropriate.

DiagnosticOrder and DiagnosticReport support the overall diagnostic process. A Diagnostic report connects the process of 'reporting', linking process identifiers, visual presenations of a report, and conclusions/interpretations with the raw Observations. Diagnostic Orders capture the request from an authorized clinician that initiates the diagnostic process. Specimen and BodySite are used to record the details of specimen collection though BodySite can also be used with other resources (e.g. Operation location details on a procedure).

The resources ImagingObjectSelection and ImagingStudy are provided to make links to diagnostic images available within the clinical record, where the actual images will be provided by dedicated systems (the [Media](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\media.html) resource is intended for sharing actual images directly, which is not generally suitable for high resolution high volume diagnostic images).

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Observation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html) | [Past](#past) | Act |  |
| [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) | [Past](#past) | Act | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [DiagnosticOrder](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) | [Future](#future) | Act | [Request/Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#order) |
| [Specimen](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\specimen.html) | [Unrelated](#unrelated) | Role | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [BodySite](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bodysite.html) | [Unrelated](#unrelated) | Role |  |
| [ImagingObjectSelection](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingobjectselection.html) | [Past](#past) | Act |  |
| [ImagingStudy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\imagingstudy.html) | [Past](#past) | Act |  |

### Administrative Resources

These resources are provide support for identifing the various entities that are involved in healthcare: people, organizations, substances, devices, etc.

#### Individuals

The Patient resource represents the recipient of healthcare. This concept is not always referred to as a 'patient' - other words such as client, customer, resident etc are commonly used, but in this specification, the recipient of healthcare is simply known as the patient. The patient resource includes basic demographics and next of kin information.

The Practitioner resource is used to identify and describe any person (or even animal) involved in the provision of care, including doctors, nurses, clerical staff, specialist support staff, etc.

RelatedPerson is used to describe individuals who are related to the patient who are involved in the healthcare process, beyond merely being next of kin - they may sign documents, administer medications, be the source of information, or simply provide care by chance at an accident.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) | [Unrelated](#unrelated) | Role | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html) | [Unrelated](#unrelated) | Role |  |
| [RelatedPerson](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\relatedperson.html) | [Unrelated](#unrelated) | Role |  |

#### Groups

In most provision of healthcare, some Organization is responsible and accountable for the care, and references appear throughout the clinical record. The organization is a legal entity that may operate at multiple locations. A HealthcareService represents the services offered by one or more organizations at a single location.

A Group is used to describe one or more individuals - usually people, though other kinds of entities are allowed. Typically, these are used with aggregate reporting, though sometimes care is provided to a set of individuals at once (some counselling procedures, public health procedures, herds of cattle, etc).

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Organization](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization.html) | [Unrelated](#unrelated) | Role |  |
| [HealthcareService](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\healthcareservice.html) | [Unrelated](#unrelated) | Role |  |
| [Group](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\group.html) | [Unrelated](#unrelated) | Entity |  |

#### Entities

Location - for where things happen. Locations are either by instance (e.g. this particular room at a given address or GPS coordinates) or by kind (e.g. the back of some ambulance). The same applies to Substance, for some kind of meterial (e.g. chemical) used in healthcare - it may refer to an identified instance (e.g. bottle) or a kind of chemical.

The Person resource is used to track associations between different patient records across the provision of healthcare (e.g. "master patient indexes"). Person resources are not referred directly from other resources; their use is for dedicated person registries.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Location](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\location.html) | [Unrelated](#unrelated) | Role | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [Substance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\substance.html) | [Unrelated](#unrelated) | Entity |  |
| [Person](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\person.html) | [Unrelated](#unrelated) | Entity |  |

#### Device

Device is used to track non-consumable manufactured materials through the healthcare process. It includes implants, large instruments, non-medical things (including software), and containers. Devices - and therefore the device resource - have may purposes, including stock control, locating devices, and tracking implants.

DeviceComponent and DeviceMetric are used to report the status and characteristics of the kinds of medical devices that produce a stream of one or more data points ([observations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation.html)), usually about a patient.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Device](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\device.html) | [Unrelated](#unrelated) | Role |  |
| [DeviceComponent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\devicecomponent.html) | [Unrelated](#unrelated) | Role |  |
| [DeviceMetric](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\devicemetric.html) | [Unrelated](#unrelated) | Role |  |

### Work Flow

#### Encounters

Encounter tracks an interaction between a patient and healthcare provider(s). Specifically, this resource tracks the administrative details of the interaction, not the clinical details (though these usual link to it). Aliases for this include 'admission', 'consultation', and sometimes 'appointment'. Encounters may be nested - e.g. when the patient goes to physiotherapy as part of a hospital admission.

An EpisodeofCare is a association between a patient and a care provider that may last over several encounters. The purpose of EpisodeOfCare is track a provider (person or organization) that has an interest in the ongoing care of the patient.

A Communication is a record of a formal communication with a patient or another party with an interest in their care - a letter, email, phone call etc.

A Flag is warning maintained in the system that alerts care providers to potential issues they should be aware of when providing care to a patient, or at a location.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Encounter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\encounter.html) | [Future](#future) / [Ongoing](#ongoing) / [Past](#past) | Act |  |
| [EpisodeOfCare](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\episodeofcare.html) |  | Act |  |
| [Communication](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\communication.html) | [Past](#past) | Act | [Clinical Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#clinical) |
| [Flag](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\flag.html) | [Ongoing](#ongoing) | Act | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |

#### Scheduling

These resources are concerned with planning times and locations for future delivery of care:

* A Schedule describes a set of times in the future that a service or individual may be available
* A Slot is an instance of a time in a schedule that may be reserved
* An Appointment is proposed or confirmed future event, with a list of participants who may or may not have confirmed their attendance
* An AppointmentResponse is an individual's acceptance or rejection of an appointment

The scheduling systems is closely aligned with the iCal system so that systems may leverage web bookings while maintaing integrity with the rest of the clinical record.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html) | [Future](#future) | Act |  |
| [AppointmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointmentresponse.html) | [Future](#future) | Act |  |
| [Schedule](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\schedule.html) | [Future](#future) |  |  |
| [Slot](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\slot.html) | [Future](#future) | Act |  |

#### Order Management

Todo: these resources are all draft. Bringing them to maturity and testing this is a major ongoing focus of the FHIR project.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\order.html) | [Present](#present) | Act |  |
| [OrderResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\orderresponse.html) | [Present](#present) | Act |  |
| [CommunicationRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\communicationrequest.html) | [Future](#future) | Act | [Request/Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#order) |
| [DeviceUseRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceuserequest.html) | [Present](#present) | Act | [Request/Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#order) |
| [DeviceUseStatement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\deviceusestatement.html) | [Past](#past) | Act |  |
| [ProcessRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processrequest.html) | [Present](#present) | Act | [Request/Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#order) |
| [ProcessResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\processresponse.html) | [Present](#present) | Act |  |
| [SupplyDelivery](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\supplydelivery.html) | [Present](#present) | Act |  |
| [SupplyRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\supplyrequest.html) | [Future](#future) | Act |  |

### Infrastructure

These resources provide generally useful functionality, and/or are referenced directly from the base FHIR framework ([RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), [messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html), [documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html)).

#### Information Management

Questionnaire and QuestionnaireResponse are for general purpose data collection from a patient or other information source- the set of questions, and the individuals response (answers to the questions). A questionnaire can contain any kind of data, including the data represented in all other resources; it is anticpated that the data will be processed into the other kind of resources for further usage and exchange.

The Provenance resource is used to make statements about the where a resource came from - that is, who, what, why, when and where for it's creation. This may be used in assessing the integrity, reliability and usefulness of a resource or the data in it. Note that many resources contain some limited amount of this information directly, because it is deemed essential to using/finding/filtering/understanding the resource directly. Whenever information is found in both a resource, and in the provenance statements for the resource, it is expected to be the same.

An AuditEvent is an observation by a system that a record was altered (created, updated, deleted), with audit information about the event. Typically, the provenance record is created before the resource is altered, by the (sub)system causing the change to the resource, while the audit record is created after the change by the (sub)system responsible for storing it.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html) | [Past](#past) | Act |  |
| [QuestionnaireResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaireresponse.html) | [Past](#past) | Act |  |
| [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) | [Past](#past) | Act |  |
| [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) | [Past](#past) | Act |  |

#### Documents

In clinical practice, there are use cases for both exchanging information in a highly granular form, and for exchanging it in packages known as 'documents'. This specification provides two different kinds of support for creating and exchanging documents:

* Composition allows for the construction of a detailed [document package](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) using a resources for all the details of the document
* DocumentReference and DocumentManifest are used for referring to and/or exchanging external documents (CDA, PDF, other kinds of records etc) either as single documents or groups of documents respectively

The List resource is used to link a set of other kinds of resources into a singe list. This might be done for many reasons - maintaining a list of work to do, or patients of interest, or a set of current problems for a patient.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html) | [Unrelated](#unrelated) | Unrelated |  |
| [DocumentManifest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentmanifest.html) | [Unrelated](#unrelated) | Document | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) |  | Document | [Entity Availability Workflow](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#entity) |
| [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html) | [Unrelated](#unrelated) | Act |  |

#### Structures

Basic support structures with general usefulness:

* Media stores an image, video, or sound recording, with metadata that can be used to link it into the rest of the healthcare record as represented in resources
* Binary is a container for content of any type, to include content that in some format other than a FHIR resource
* Bundle acts as an envelope for a set of other resources as they are gathered toegether for exchange. Bundles may be long lived (documents) or very short lived (search results)
* Basic is a general container that can be used to represent data for which a specific resource doesn't yet exist (general extension point)

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Media](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\media.html) | [Past](#past) | Act |  |
| [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\binary.html) | Unrelated | Entity |  |
| [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) | [Unrelated](#unrelated) | Entity |  |
| [Basic](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\basic.html) | [Unrelated](#unrelated) | InfrastructureRoot |  |

#### Exchange

These resources support the exchange process directly:

* MessageHeader is the header for a message - identifies it context, sender and reciever, and content
* OperationOutcome is returned to indicate the detailed outcome of a particular FHIR operation or interaction - success, or failure
* Parameters is input or output to [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html)
* Subscription allows one system to subscribe to events on another system

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [MessageHeader](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messageheader.html) | [Present](#present) | Act |  |
| [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) | [Present](#present) | Act |  |
| [Parameters](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\parameters.html) | [Present](#present) | InfrastructureRoot |  |
| [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html) | [Present](#present) | Act |  |

### Conformance

This specification is a base platform specification that defines a set of general capabilities. Specific systems build on top of that to create interoperable solutions by [making a set of conformance rules](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html). These conformance rules are supported by a this set of "conformance" resources.

#### Terminology

A ValueSet defines a set of codes from a [code system](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html) that are used for validation, lookup etc. A ConceptMap maps value sets between different code systems.

A NamingSystem resource represents and external provider of codes or identifiers (e.g. a external code system such as SNOMED CT, or an identification system such as an institution MRN. The naming system resource exists to share the identification and registration of these systems, to foster consistency in their identification.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) | [Unrelated](#unrelated) |  |  |
| [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) | [Unrelated](#unrelated) |  |  |
| [NamingSystem](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\namingsystem.html) | [Unrelated](#unrelated) |  |  |

#### Content

StructureDefinition and DataElement both describe a set of data elements that can represent data for the purposes of collection, analysis and exchange. They have slightly different purposes:

* StructureDefinition is used specifically to describe the structures used by or with this specification
* DataElement describes more general data items that are represented and exchanged in many formats and/or contexts

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) | [Unrelated](#unrelated) |  |  |
| [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html) | [Unrelated](#unrelated) | Entity |  |

#### Behavior

A Conformance is a statement of a set of system capabilities for use as system discovery, or conformance expectations.

An OperationDefinition describes an operation that can be executed on a server, and a SearchParameter defines a search parameter that can be used on a server.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Conformance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) | Unrelated |  |  |
| [OperationDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html) | [Unrelated](#unrelated) |  |  |
| [SearchParameter](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\searchparameter.html) | [Unrelated](#unrelated) |  |  |

#### Miscellaneous

ImplementationGuide is used to gather all the other resources into a single package for publication, and also to define the bounds of an interoperability solution.

A TestScript specifies a series of operations and outcomes that a system is expected to meet. Test Scripts are for develpoment and acceptance testing, but may also be considered for use with production systems, if the tests are carefully constructed and vetted.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [ImplementationGuide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\implementationguide.html) | [Unrelated](#unrelated) |  |  |
| [TestScript](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\testscript.html) | [Unrelated](#unrelated) |  |  |

### Financial

These resources are all in draft status, and more details will be provided here in due course.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resource** | **Category** | **RIM** | **Lifecycle** |
| [Coverage](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\coverage.html) | [Ongoing](#ongoing) | Act |  |
| [EligibilityRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityrequest.html) | [Present](#present) | Act |  |
| [EligibilityResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\eligibilityresponse.html) | [Present](#present) | Act |  |
| [EnrollmentRequest](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentrequest.html) | [Present](#present) | Act |  |
| [EnrollmentResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\enrollmentresponse.html) | [Present](#present) | Act |  |
| [Claim](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claim.html) | [Present](#present) | Act |  |
| [ClaimResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\claimresponse.html) | [Present](#present) | Act |  |
| [PaymentNotice](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentnotice.html) | [Past](#past) | Act |  |
| [PaymentReconciliation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\paymentreconciliation.html) | [Past](#past) | Act |  |
| [ExplanationOfBenefit](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\explanationofbenefit.html) | [Past](#past) | Act |  |

# resourcelist-examples.html

## Resource Examples

TODO: fill this page out.

# resourcelist.html

## Resource Index

* [Categorized](#tabs-1)
* [Alphabetical](#tabs-2)

This page is provided to help find resources quickly. There is also a more [detailed classification, ontology, and description](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourceguide.html).

|  |  |  |  |
| --- | --- | --- | --- |
| [**Clinical**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinical.html) | | | |
| **General:**   * [AllergyIntolerance](allergyintolerance.html) * [Condition](condition.html) (Problem) * [Procedure](procedure.html) * [ClinicalImpression](clinicalimpression.html) * [FamilyMemberHistory](familymemberhistory.html) * [RiskAssessment](riskassessment.html) * [DetectedIssue](detectedissue.html) | **Care Provision:**   * [CarePlan](careplan.html) * [Goal](goal.html) * [ReferralRequest](referralrequest.html) * [ProcedureRequest](procedurerequest.html) * [NutritionOrder](nutritionorder.html) * [VisionPrescription](visionprescription.html) | **Medication & Immunization:**   * [Medication](medication.html) * [MedicationOrder](medicationorder.html) * [MedicationAdministration](medicationadministration.html) * [MedicationDispense](medicationdispense.html) * [MedicationStatement](medicationstatement.html) * [Immunization](immunization.html) * [ImmunizationRecommendation](immunizationrecommendation.html) | **Diagnostics:**   * [Observation](observation.html) * [DiagnosticReport](diagnosticreport.html) * [DiagnosticOrder](diagnosticorder.html) * [Specimen](specimen.html) * [BodySite](bodysite.html) * [ImagingStudy](imagingstudy.html) * [ImagingObjectSelection](imagingobjectselection.html) |
| [**Identification**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html) | | | |
| **Individuals:**   * [Patient](patient.html) * [Practitioner](practitioner.html) * [RelatedPerson](relatedperson.html) | **Groups:**   * [Organization](organization.html) * [HealthcareService](healthcareservice.html) * [Group](group.html) | **Entities:**   * [Location](location.html) * [Substance](substance.html) * [Person](person.html) | **Devices:**   * [Device](device.html) * [DeviceComponent](devicecomponent.html) * [DeviceMetric](devicemetric.html) |
| [**Workflow**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\administration.html) | | | |
| **Patient Management:**   * [Encounter](encounter.html) * [EpisodeOfCare](episodeofcare.html) * [Communication](communication.html) * [Flag](flag.html) | **Scheduling:**   * [Appointment](appointment.html) * [AppointmentResponse](appointmentresponse.html) * [Schedule](schedule.html) * [Slot](slot.html) | **Workflow #1:**   * [Order](order.html) * [OrderResponse](orderresponse.html) * [CommunicationRequest](communicationrequest.html) * [DeviceUseRequest](deviceuserequest.html) * [DeviceUseStatement](deviceusestatement.html) | **Workflow #2:**   * [ProcessRequest](processrequest.html) * [ProcessResponse](processresponse.html) * [SupplyRequest](supplyrequest.html) * [SupplyDelivery](supplydelivery.html) |
| [**Infrastructure**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\infrastructure.html) | | | |
| **Information Tracking:**   * [Questionnaire](questionnaire.html) * [QuestionnaireResponse](questionnaireresponse.html) * [Provenance](provenance.html) * [AuditEvent](auditevent.html) | [**Documents**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) **& Lists:**   * [Composition](composition.html) * [DocumentManifest](documentmanifest.html) * [DocumentReference](documentreference.html) * [List](list.html) | **Structure:**   * [Media](media.html) * [Binary](binary.html) * [Bundle](bundle.html) * [Basic](basic.html) | **Exchange:**   * [MessageHeader](messageheader.html) * [OperationOutcome](operationoutcome.html) * [Parameters](parameters.html) * [Subscription](subscription.html) |
| [**Conformance**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\infrastructure.html) | | | |
| **Terminology:**   * [ValueSet](valueset.html) * [ConceptMap](conceptmap.html) * [NamingSystem](namingsystem.html) | **Content:**   * [StructureDefinition](structuredefinition.html) * [DataElement](dataelement.html) | **Operations Control:**   * [Conformance](conformance.html) * [OperationDefinition](operationdefinition.html) * [SearchParameter](searchparameter.html) | **Misc:**   * [ImplementationGuide](implementationguide.html) * [TestScript](testscript.html) |
| [**Financial**](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\financial.html) | | | |
| **Support:**   * [Coverage](coverage.html) * [EligibilityRequest](eligibilityrequest.html) * [EligibilityResponse](eligibilityresponse.html) * [EnrollmentRequest](enrollmentrequest.html) * [EnrollmentResponse](enrollmentresponse.html) | **Billing:**   * [Claim](claim.html) * [ClaimResponse](claimresponse.html) | **Payment:**   * [PaymentNotice](paymentnotice.html) * [PaymentReconciliation](paymentreconciliation.html) | **Other:**   * [ExplanationOfBenefit](explanationofbenefit.html) |

|  |  |  |  |
| --- | --- | --- | --- |
| **Alphabetical** | | | |
| **A-D:**   * [AllergyIntolerance](allergyintolerance.html) * [Appointment](appointment.html) * [AppointmentResponse](appointmentresponse.html) * [AuditEvent](auditevent.html) * [Basic](basic.html) * [Binary](binary.html) * [BodySite](bodysite.html) * [Bundle](bundle.html) * [CarePlan](careplan.html) * [Claim](claim.html) * [ClaimResponse](claimresponse.html) * [ClinicalImpression](clinicalimpression.html) * [Communication](communication.html) * [CommunicationRequest](communicationrequest.html) * [Composition](composition.html) * [ConceptMap](conceptmap.html) * [Condition](condition.html) (aka Problem) * [Conformance](conformance.html) * [DetectedIssue](detectedissue.html) * [Coverage](coverage.html) * [DataElement](dataelement.html) * [Device](device.html) | **D-L:**   * [DeviceComponent](devicecomponent.html) * [DeviceMetric](devicemetric.html) * [DeviceUseRequest](deviceuserequest.html) * [DeviceUseStatement](deviceusestatement.html) * [DiagnosticOrder](diagnosticorder.html) * [DiagnosticReport](diagnosticreport.html) * [DocumentManifest](documentmanifest.html) * [DocumentReference](documentreference.html) * [EligibilityRequest](eligibilityrequest.html) * [EligibilityResponse](eligibilityresponse.html) * [Encounter](encounter.html) * [EnrollmentRequest](enrollmentrequest.html) * [EnrollmentResponse](enrollmentresponse.html) * [EpisodeOfCare](episodeofcare.html) * [ExplanationOfBenefit](explanationofbenefit.html) * [FamilyMemberHistory](familymemberhistory.html) * [Flag](flag.html) * [Goal](goal.html) * [Group](group.html) * [HealthcareService](healthcareservice.html) * [ImagingObjectSelection](imagingobjectselection.html) * [ImagingStudy](imagingstudy.html) * [Immunization](immunization.html) | **I-P:**   * [ImmunizationRecommendation](immunizationrecommendation.html) * [ImplementationGuide](implementationguide.html) * [List](list.html) * [Location](location.html) * [Media](media.html) * [Medication](medication.html) * [MedicationAdministration](medicationadministration.html) * [MedicationDispense](medicationdispense.html) * [MedicationOrder](medicationorder.html) * [MedicationStatement](medicationstatement.html) * [MessageHeader](messageheader.html) * [NamingSystem](namingsystem.html) * [NutritionOrder](nutritionorder.html) * [Observation](observation.html) * [OperationDefinition](operationdefinition.html) * [OperationOutcome](operationoutcome.html) * [Order](order.html) * [OrderResponse](orderresponse.html) * [Organization](organization.html) * [Parameters](parameters.html) * [Patient](patient.html) * [PaymentNotice](paymentnotice.html) * [PaymentReconciliation](paymentreconciliation.html) * [Person](person.html) | **P-Z:**   * [Practitioner](practitioner.html) * [Procedure](procedure.html) * [ProcessRequest](processrequest.html) * [ProcessResponse](processresponse.html) * [ProcedureRequest](procedurerequest.html) * [Provenance](provenance.html) * [Questionnaire](questionnaire.html) * [QuestionnaireResponse](questionnaireresponse.html) * [ReferralRequest](referralrequest.html) * [RelatedPerson](relatedperson.html) * [RiskAssessment](riskassessment.html) * [Schedule](schedule.html) * [SearchParameter](searchparameter.html) * [Slot](slot.html) * [Specimen](specimen.html) * [StructureDefinition](structuredefinition.html) * [Subscription](subscription.html) * [Substance](substance.html) * [SupplyRequest](supplyrequest.html) * [SupplyDelivery](supplydelivery.html) * [TestScript](testscript.html) * [ValueSet](valueset.html) * [VisionPrescription](visionprescription.html) |

Additional Resources will be added in the future. A list of hypothesized resources can be found on the [HL7 wiki](http://wiki.hl7.org/index.php?title=FHIR_Resource_Types). Feel free to add any you think are missing or engage with one of the [HL7 Work Groups](http://www.hl7.org/Special/committees/index.cfm) to submit a [proposal](http://wiki.hl7.org/index.php?title=Category:FHIR_Resource_Proposal) to define a resource of particular interest.

# resources-definitions.html

## Resources - Detailed Descriptions

### Resource

# resources-examples.html

## Resource Format Examples

The specification includes many example resources. Most of the examples can be found in the examples section for each defined resource. In addition, there are some general examples of sets of resources:

* [Integrated Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\integrated-examples.html)

# resources.html

# rxnorm.html

## Using RxNorm with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | RxNorm is made available by the [US National Library of Medicine](http://www.nlm.nih.gov/) at <http://www.nlm.nih.gov/research/umls/rxnorm> |
| System | The URI <http://www.nlm.nih.gov/research/umls/rxnorm> identifies the RxNorm code system |
| Version | Where a version is used, it should be the date of release, encoded as in the download files, e.g. "07092014" |
| Code | The code value for an RxNorm code is a Concept Identifier (CUI), and only CUIs for which there is an SAB=RXNORM |
| Display | The correct display for CUI is the String description for it associated with the source RXNORM. Display values are not case sensitive |
| Filter Properties | Several properties are defined as described below |

### RxNorm MySQL Database

The RxNorm scripts are able to populate a MySQL database that contains the data from RxNorm. This page provides SQL statements that describe how to implement the features of the RxNorm terminology correctly against this database. These are provided for implementer convenience, and do not imply that any particular approach be used in implementations.

For example, the correct display name for a CUI is 'Select STR from rxnconso where RXCUI = :code and SAB = 'RXNORM' and TTY <> 'SY'.

### Copyright/License Issues

The use of RxNorm codes and display names in this specification is pursuant to HL7's status as a licensee of the NLM UMLS. This license does not convey the right to use RxNorm to any users of this specification; implementers must acquire a license to use RxNorm in their own right.

The [license for RxNorm](https://uts.nlm.nih.gov/license.html) places restrictions on the distribution of the UMLS Metathesaurus or subsets of it. We are seeking a clarification of what constitutes a "subset of the metathesaurus" in order to make it clear what the status of an RxNorm value set is.

### RxNorm Filter Properties

This section documents the property filters that can be used with the RxNorm code system in value set composition statements.

The base SQL statement for returning a list of CUIS that conform to these filters is:

Select RXCUI from rxnconso where SAB = 'RXNORM' and TTY <> 'SY'

#### Semantic Type

|  |  |
| --- | --- |
| Description | Allows to choose a set of CUIs based on their Semantic Type |
| Property Name | STY |
| Operations Allowed | = / in |
| Values Allowed | [column:]value |
| Comments | If not column is specified, the default column is TUI |
| SQL | and RXCUI in (select RXCUI from rxnsty where [:column] = :value) |

#### Source

|  |  |
| --- | --- |
| Description | Allows for selection of the set of concepts that have mappings to a particular rxnorm source |
| Property Name | SAB |
| Operations Allowed | = / in |
| Values Allowed | Values from RxNorm SAB table (e.g. select RSAB from rxnsab) |
| SQL | and RXCUI in (select RXCUI from rxnconso where SAB = :value) |

#### Term Type

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on its designated type |
| Property Name | TTY |
| Operations Allowed | = / in |
| Values Allowed | TTY values from the RxNorm Concept table (e.g. select distinct TTY from rxnconso) |
| SQL | and TTY = :value |

#### Relationship

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on its relationships |
| Property Name | [REL] |
| Operations Allowed | = / in |
| Values Allowed | CUI:[RXCUI] or AUI:[RXAUI] must be a valid CUI or AUI. Note that a CUI does not need to have a SAB=RXNORM entry to be used here |
| Comments | [REL] (:rel) is one of SY, SIB, RN, PAR, CHD, RB or RO |
| SQL | for CUI:  and (RXCUI in (select RXCUI from rxnconso where RXCUI in (select RXCUI1 from rxnrel where REL = :rel and RXCUI2 = :value))  for AUI:  and (RXCUI in (select RXCUI from rxnconso where RXAUI in (select RXAUI1 from rxnrel where REL = :rel and RXAUI2 = :value)) |

#### Relationship Type

|  |  |
| --- | --- |
| Description | Allows for selection of a concept based on the type of its relationships |
| Property Name | [RELA] |
| Operations Allowed | = / in |
| Values Allowed | CUI:[RXCUI] or AUI:[RXAUI] must be a valid CUI or AUI. Note that a CUI does not need to have a SAB=RXNORM entry to be used here |
| Comments | [RELA] (:rela) is one of the relationship types below |
| SQL | for CUI:  and (RXCUI in (select RXCUI from rxnconso where RXCUI in (select RXCUI1 from rxnrel where RELA = :rel and RXCUI2 = :value))  for AUI:  and (RXCUI in (select RXCUI from rxnconso where RXAUI in (select RXAUI1 from rxnrel where RELA = :rel and RXAUI2 = :value)) |

**Relationship Types**

* active\_ingredient\_of
* active\_metabolites\_of
* chemical\_structure\_of
* consists\_of
* constitutes
* contained\_in
* contains
* contraindicated\_with\_disease
* contraindicating\_class\_of
* contraindicating\_mechanism\_of\_action\_of
* contraindicating\_physiologic\_effect\_of
* doseformgroup\_of
* dose\_form\_of
* effect\_may\_be\_inhibited\_by
* entry\_version\_of
* form\_of
* has\_active\_ingredient
* has\_active\_metabolites
* has\_chemical\_structure
* has\_contraindicated\_drug
* has\_contraindicating\_class
* has\_contraindicating\_mechanism\_of\_action
* has\_contraindicating\_physiologic\_effect
* has\_doseformgroup
* has\_dose\_form
* has\_entry\_version
* has\_form
* has\_ingredient
* has\_ingredients
* has\_mechanism\_of\_action
* has\_member
* has\_part
* has\_participant
* has\_permuted\_term
* has\_pharmacokinetics
* has\_physiologic\_effect
* has\_precise\_ingredient
* has\_print\_name
* has\_product\_component
* has\_quantified\_form
* has\_sort\_version
* has\_therapeutic\_class
* has\_tradename
* included\_in
* includes
* induced\_by
* induces
* ingredients\_of
* ingredient\_of
* inverse\_isa
* isa
* mapped\_from
* mapped\_to
* may\_be\_diagnosed\_by
* may\_be\_prevented\_by
* may\_be\_treated\_by
* may\_diagnose
* may\_inhibit\_effect\_of
* may\_prevent
* may\_treat
* mechanism\_of\_action\_of
* member\_of
* metabolic\_site\_of
* participates\_in
* part\_of
* permuted\_term\_of
* pharmacokinetics\_of
* physiologic\_effect\_of
* precise\_ingredient\_of
* print\_name\_of
* product\_component\_of
* quantified\_form\_of
* reformulated\_to
* reformulation\_of
* site\_of\_metabolism
* sort\_version\_of
* therapeutic\_class\_of
* tradename\_of

### Implicit Value Sets

Implicit value sets are those whose specification can be predicted based on the grammar of the underlying code system, and the known structure of the URL that refers to them. RxNorm does not (yet) have any defined implicit value sets.

The value set identifier http://www.nlm.nih.gov/research/umls/rxnorm/vs is a value set that contains all RxNorm CUIs.

# sc.html

# FHIR Status Codes Grid

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This is an internal QA page. The intent of this table is to help reviewers compare the usage of status codes across resources: where the status code means the same thing, it should have the same code. The columns have no formal definition; their intent is to be inferred from the codes listed in the column.

Note: this page is not proscriptive; it's descriptive and comparative, to help with review. The FHIR methodology says that if two domains use different terms for the same concept (e.g. 'withdrawn' and 'cancelled') then the domain concept name should be used. On other hand, where there is no explicit reason for the codes to differ based on domain usage, they should not.

Note: **bold** means the element is marked as a modifier.

# search.html

## Search

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

One aspect that is fundamental to the way FHIR works is to search a set of resources. Search operations search through an existing set of resources by a set of search criteria supplied as parameters to the search. This page documents the FHIR search framework, starting with the simple cases, and working through to the full complexity. Implementations need only implement the amount of complexity that they require.

### Summary Table

|  |  |  |
| --- | --- | --- |
| **Search Parameter Types** | **Parameters for all resources** | **Search result parameters** |
|  | [\_id](#id) [\_lastUpdated](#lastUpdated) [\_tag](#tag) [\_profile](#profile) [\_security](#security) [\_text](#text) [\_content](#content) [\_list](#list) [\_query](#query) | [\_sort](#sort) [\_count](#count) [\_include](#include) [\_revinclude](#revinclude) [\_summary](#summary) [\_elements](#elements) [\_contained](#contained) [\_containedType](#containedType) |

In addition, there is a special search parameter [\_filter](#filter) that allows a different method of searching.

### Introduction

In the simplest case, a search is executed by performing a GET operation in the RESTful framework:

GET [base]/[resourcetype]?name=value&...

For this RESTful search (see [definition in RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search)), the parameters are a series of name=[value] pairs encoded in the URL or as an application/x-www-form-urlencoded submission for a POST:

POST [base]/[type]/\_search{?[parameters]{&\_format=[mime-type]}}

The server determines which of the set of resources it serves meet the specific criteria, and returns the results in the HTTP response as a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) which includes the resources that are the results of the search.

[Search operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) are executed in one of 3 defined contexts that control which set of resources are being searched:

* A specified resource type: GET [base]/[ResourceType]?parameter(s)
* A specified [compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartments), perhaps with a specified resource type in that compartment: GET [base]/Patient/[id]/[ResourceType]?parameter(s)
* All resource types: GET [base]/\_search?parameter(s) (parameters common to all types only)

Search operations can also be implemented in [the messaging framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html#search).

The server determination of which resources meet the criteria contained in the search parameters as described below. However the server has the prerogative to return additional search results if it believes them to be relevant. Note, though, that there is a special search for the most relevant context in which the search set is indeterminate: [Patient MPI Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#mpi).

Search using GET may include sensitive information in the search parameters therefore secure communications and endpoint management are recommended, see [Security Communications](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#http)

### Handling Errors

If a server is unable to execute a search request, it may return an error. A HTTP status code of 403 signifies that the server refused to perform the search, while some other 4xx or 5xx code signifies that some error occurred. When the search fails, a server SHOULD return an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) detailing the cause of the failure. Note that an empty search result is not a failure.

In some cases, some of the parameters may have problems. For instance:

* A parameter may refer to a non-existent resource e.g. GET [base]/Observation?subject=101, where 101 does not exist
* A parameter may refer to an unknown code e.g. GET [base]/Observation?code=loinc|1234-1, where the LOINC code 1234-1 is not known to the server
* A parameter may refer to a time that is out of scope e.g. GET [base]/Condition?onset=le1995, where the system only has data going back to 2001
* A parameter may use an illegal or unaaceptable modifier e.g. GET [base]/Condition?onset:text=1995, where the modifier cannot be processed by the server
* A data time parameter may have incorrect format e.g. GET [base]/Condition?onset=23%20May%202009

Where the content of the parameter is syntactically correct, servers SHOULD return an error. However where the issue is a logical condition (e.g. unknown subject or code), the server SHOULD process the search, including processing the parameter - with the effect of returning an empty search set, since the parameter cannot be satisfied.

In such cases, the search process MAY include an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) in the search set that contains additional hints and warnings about the search process. This is included in the search results as an entry with [search mode](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.entry.search.mode) = [outcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-search-entry-mode.html). Clients can use this information to improve future searches.

### Standard Parameters

#### Parameters for all resources

These parameters are [defined that apply to all resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#search): . In addition, the search parameter [\_text](#text) and [\_filter](#filter), (documented below) also applies to all resources (as do the search result parameters).

The search parameter \_id refers to the logical id of the resource, and can be used when the search context specifies a resource type:

GET [base]/Patient?\_id=23

This search finds the patient resource with the given id (there can only be one resource for a given id). Functionally, this is equivalent to a [simple read operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read):

GET [base]/Patient/23

however the search with parameter \_id returns a bundle with the requested resource, instead of just the resource itself. Additional parameters can be added which may provide additional functionality on top of this base read equivalence (e.g. [\_include](#include)).

The search parameter \_lastUpdated can be used to select resources based on the last time they were changed:

GET [base]/Observation?\_lastUpdated=>2010-10-01

This search finds any observations changed since 1-Oct 2010. When this search parameter is used, applications should consider synchronization approaches ([RESTful history](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#history) or the [Subscription resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html)).

The search parameters \_tag, \_profile and \_security parameters search on the equivalent elements in the [meta element](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#meta). For example

GET [base]/Condition?\_tag=http://acme.org/codes|needs-review

searches for all Condition resources with the tag:

{

"system" : "http://acme.org/codes",

"code" : "needs-review"

}

In the same manner:

GET [base]/DiagnosticReport?\_profile=http://hl7.org/fhir/StructureDefinition/lipid

GET [base]/DiagnosticReport?\_profile=Profile/lipid

restricts the search to only DiagnosticReport resources that are tagged that they conform to a particular profile. The second reference is relative, and refers a local profile on the same server.

\_tag, \_profile and \_security parameters are all token types (see [below](#token)).

#### Parameters for each resource

In addition to the \_id parameter which exists for all resources, each FHIR resource type defines its own set of search parameters with their names, types, and meanings. These search parameters are on the same page as the resource definitions, and are also published as part of the standard conformance statement ([XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-base.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-base.json.html)).

Mostly, the defined search parameters correspond to a single element in the resource, but this is not required, and some search parameters refer to the same type of element in multiple places, or refer to derived values.

Some of the search parameters defined by the resources are associated with more than one path in the resource. This means that the search parameter matches if any of the paths contain matching content, and which ever path matches, the whole resource is returned in the search results. The client may have to examine the resource to determine which path contains the match.

Servers are not required to implement any of these search parameters (except for the \_id parameter described above), and may define their own additional parameters if they wish.

#### Search Parameter Types

Each search parameter is defined with a type that defines how the search parameter behaves. These are the defined parameter types:

The search parameters can also have "modifiers" appended to them that control their behavior. The kinds of modifiers that can be used depend on the type of parameter.

#### Modifiers

Parameters are defined per resource, and their names may additionally specify a modifier as a suffix, separated from the parameter name by a colon. Modifiers are:

* For all parameters (except combination): :missing. E.g. gender:missing=true (or false). Searching for "gender:missing=true" will return all the resources that don't have any value for the gender parameter (which usually equates to not having the relevant element in the resource). Searching for "gender:missing=false" will return all the resources that have a value for the "gender" parameter.
* For string: :exact (the match needs to be exact, no partial matches, case sensitive and accent-sensitive), or :contains (case insensitive and accent-insensitive, partial match at start or end), instead of the default behavior (case insensitive and accent-insensitive, partial matches at the end of the string)
* For token: :text (the match does a partial searches on the text portion of a CodeableConcept or the display portion of a Coding), instead of the default search which uses codes. Other defined modifiers are :in, :below, :above and :not-in which are described below
* For reference: :[type] where [type] is the name of a type of resource
* For uri: :below, :above indicate that instead of an exact match, either the search term left matches the value, or vice-versa

Server SHALL reject any search request that contains is suffixed by a modifier that the server does **not** support for that parameter. For example, if the server supports the "name" search param, but not the ":exact" modifier on the name, it should reject a search with the parameter "name:exact=Bill", using an HTTP 400 error with an [OperationOutcome](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\operationoutcome.html) with a [clear error message](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome-example-searchfail.html).

#### Prefixes

For the ordered parameter types [number](" \l "number), [date](#date), and [quantity](#quantity), a prefix to the parameter value may be used to control the nature of the matching. To avoid URL escaping and visual confusion, the following prefixes are used:

|  |  |  |
| --- | --- | --- |
| eq | the value for the parameter in the resource is equal to the provided value | the range of the search value fully contains the range of the target value |
| ne | the value for the parameter in the resource is not equal to the provided value | the range of the search value does not fully contain the range of the target value |
| gt | the value for the parameter in the resource is greater than the provided value | the range above the search value intersects (i.e. overlaps) with the range of the target value |
| lt | the value for the parameter in the resource is less than the provided value | the range below the search value intersects (i.e. overlaps) with the range of the target value |
| ge | the value for the parameter in the resource is greater or equal to the provided value | the range above the search value intersects (i.e. overlaps) with the range of the target value, or the range of the search value fully contains the range of the target value |
| le | the value for the parameter in the resource is less or equal to the provided value | the range below the search value intersects (i.e. overlaps) with the range of the target value or the range of the search value fully contains the range of the target value |
| sa | the value for the parameter in the resource starts after the provided value | the range of the search value does overlap with the range of the target value, and the range below the search value contains the range of the target value |
| eb | the value for the parameter in the resource ends before the provided value | the range of the search value does overlap with the range of the target value, and the range above the search value contains the range of the target value |
| ap | the value for the parameter in the resource is approximately the same to the provided value. Note that the recommended value for the approximation is 10% of the stated value (or for a date, 10% of the gap between now and the date), but systems may choose other values where appropriate | the range of the search value overlaps with the range of the target value |

If no prefix is present, the prefix 'eq' is assumed. Note that the way search parameters operate is not the same as the way the operations on two numbers work in a mathematical sense. sa ('starts-after') and eb ('ends-before') are not used with integer values.

For each prefix above, two interpretations are provided - the simple intent of the prefix, and the interpretation of the parameter when applied to ranges. The range interpretation is provided because for decimals and dates, the searches are always performed on values that are implicitly or explicitly a range. For instance, the number 2.0 has an implicit range of 1.95 to 2.05, and the date 2015-08-12 has an implicit range of the all the time during that day. If the target value is a [Range](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#range), a [Period](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#period), or a [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#timing), then the target is explicitly a range. Three ranges are identified:

|  |  |  |
| --- | --- | --- |
| range of the value | The limits implied by the precision of the value | The number 2.0 has a range of 1.95 to 2.05 The date 2015-08-12 has a range from 00:00 to 00:00 exclusive |
| range below the value | Up to the specified value | The range below 2.0 includes any value less or equal to <2.00000000000000000000 The range before 2015-08-12T05:23:45 includes any time up to 2015-08-12T05:23:45.000000000000000 |
| range above the value | The specified value and up | The range above 2.0 includes any value greater or equal to <2.00000000000000000000 The range after 2015-08-12T05:23:45 includes any time up to 2015-08-12T05:23:45.000000000000000 |

The proper use of these is discussed further below.

#### number

Sarching on a simple numerical value in a resource. Examples:

|  |  |
| --- | --- |
| [parameter]=100 | Values that equal 100, to 3 significant figures precision, so range [99.5 ... 100.5) |
| [parameter]=100.00 | Values that equal 100, to 5 significant figures precision, so range [99.995 ... 100.005). Whole numbers also equal 100.00, but not 100.01 |
| [parameter]=lt100 | Values that are less than 100 |
| [parameter]=le100 | Values that are less or equal to 100 |
| [parameter]=gt100 | Values that are greater than 100 |
| [parameter]=ge100 | Values that are greater or equal to 100 |
| [parameter]=ne100 | Values that are not equal to 100 |

Note that uncertainty does not factor in evaluations, and the precision of the numbers is considered arbitrarily high (the way these search parameters operate here is not the same as whether two numbers are equal to each other in a mathematical sense).

Here are some example searches:

|  |  |
| --- | --- |
| **Search** | **Description** |
| GET [base]/Encounter?length=gt20 | Search for all the encounters longer than 20 days |
| GET [base]/ImmunizationRecommendation?deo-number=2 | Search for any immunization recommendation recommending a second dose |

#### date

A date parameter searches on a date/time or period. As is usual for date/time related functionality, while the concepts are relatively straight-forward, there are a number of subtleties involved in ensuring consistent behavior.

The date parameter format is yyyy-mm-ddThh:nn:ss(TZ) (the standard XML format).

Technically, this is any of the [date](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\datatypes.html" \l "date), [dateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime), and [instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#instant) data types. e.g. Any degree of precision can be provided, but it SHALL be populated from the left (e.g. can't specify a month without a year), except that the minutes SHALL be present if an hour is present, and you SHOULD provide a time zone if the time part is present. Note that the time can be just hours and minutes with no seconds, unlike the XML Schema dateTime type. Some user agents may escape the ":" characters in the URL, and servers SHALL handle this correctly.

Date parameters may be used with the following data types:

|  |  |
| --- | --- |
| [date](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#date) | The range of the value is the day, month, or year as specified |
| [dateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime) | The range of the value as defined above. e.g. For example, the date 2013-01-10 specifies all the time from 00:00 on 10-Jan 2013 to immediately before 00:00 on 11-Jan 2013 |
| [instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#instant) | An instant is considered a fixed point in time with an interval smaller than the precision of the system, i.e. an interval with an effective width of 0 |
| [Period](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period) | Explicit, though the upper or lower bound may not actually be specified in resources |
| [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing) | the specified scheduling details are ignored and only the outer limits matter. For instance, a schedule that specifies every second day between 31-Jan 2013 and 24-Mar 2013 includes 1-Feb 2013, even though that is on an odd day that is not specified by the period. This is to keep the server load processing queries reasonable |

Implicitly, a missing lower boundary is 'less than' any actual date. A missing upper boundary is 'greater than' any actual date. The use of the prefixes:

|  |  |
| --- | --- |
| [parameter]=eq2013-01-14 | matches 2013-01-14T00:00 (obviously) and also 2013-01-14T10:00 but not 2013-01-15T00:00 |
| [parameter]=ne2013-01-14 | matches 2013-01-15T00:00 but not 2013-01-14T00:00 or 2013-01-14T10:00 |
| [parameter]=lt2013-01-14T10:00 | Includes the time 2013-01-14, because it includes the part of 14-Jan 2013 before 10am |
| [parameter]=gt2013-01-14T10:00 | Includes the time 2013-01-14, because it includes the part of 14-Jan 2013 after 10am |
| [parameter]=ge2013-03-14 | Incldues the period from 21-Jan 2013 onwards, because it may include times after 14-Mar 2013 |

Other notes:

* When the date parameter is not fully specified, matches against it are based on the behavior of intervals, where:
  + Dates with just the year specified are equivalent to an interval that starts at the first instant of January 1st to the last instant of December 31st, e.g. 2000 is equivalent to an interval of [2000-01-01T00:00, 2000-12-31T23:59]
  + Dates with the year and month are equivalent to an interval that starts at the first instant of the first day of the month and ends on the last instant of the last day of the month, e.g. 2000-04 is equivalent to an interval of [2000-04-01T00:00, 2000-04-30T23:59]
* Where possible, the system should correct for timezones when performing queries. Dates do not have time zones, and time zones should not be considered. Where both search parameters and resource element date times do not have time zones, the servers local time zone should be assumed.

To search for all the procedures in a patient compartment that occurred over a 2 year period:

GET [base]/Patient/23/Procedure?date=ge2010-01-01&date=le2011-12-31

#### string

The string parameter refers to simple string searches against sequences of characters. Matches are case- and accent- insensitive. By default, a field matches a string query if the value of the field equals or starts with the supplied parameter value, after both have been normalized by case and accent. The :contains modifier returns results that include the supplied parameter value anywhere within the field being searched. The :exact modifier returns results that exactly match the supplied parameter (the whole string, including casing and accents).

Examples:

|  |  |
| --- | --- |
| [base]/Patient?name=eve | any patients with a name containing "eve" at the start of the name. This would include patients with the name "Eve", "Evelyn" |
| [base]/Patient?name:contains=eve | any patients with a name containing "eve" at any position. This would include patients with the name "Eve", "Evelyn", and also "Severine" |
| [base]/Patient?name:exact=Eve | any patients with a name that is exactly "Eve". Note that this would not include patients with the name "eve" or "EVE" |

An additional modifier :text can be used to specify a search with advanced text handling (see [below](" \l "text)) though only a few servers are expected to offer this facility.

It is at the discretion of the server whether to pre-process names, addresses, and contact details to remove separator characters prior to matching in order to ensure more consistent behavior. For example, a server might remove all spaces and "-" characters from phone numbers. What is most appropriate varies depending on culture and context.

#### uri

The uri parameter refers to an element which is URI ([RFC 3986](https://tools.ietf.org/html/rfc3986)). Matches are precise (e.g. case, accent, and escape) sensitive, and the entire URI must match. The modifier :above or :below can be used to indicate that partial matching is used. For example:

GET [base]/ValueSet?url=http://acme.org/fhir/ValueSet/123

GET [base]/ValueSet?url:below=http://acme.org/fhir/

The first is a request to find any value set with the exact url "http://acme.org/fhir/ValueSet/123". The second search will return any value sets that have a URL that starts with "http://acme.org/fhir/". The converse - the search for any value set above a given specific URL - may be useful for searching name systems, but it is generally less useful than the :below search.

#### token

A token type is a parameter that searches on a pair, a URI and a value. It is used against code or identifier value where the value may have a URI that scopes its meaning. The search is performed against the pair from a Coding or an Identifier. The syntax for the value is one of the following:

* **[parameter]=[code]**: the value of [code] matches a Coding.code or Identifier.value irrespective of the value of the system property
* **[parameter]=[system]|[code]**: the value of [code] matches a Coding.code or Identifier.value, and the value of [system] matches the system property of the Identifier or Coding
* **[parameter]=|[code]**: the value of [code] matches a Coding.code or Identifier.value, and the Coding/Identifier has no system property

Note that the namespace URI and code both must be [escaped](" \l "escaping). Matches are literal (e.g. not based on subsumption or other code system features), but not case sensitive.

Token search parameters are used for the following data types:

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Type** | **URI** | **Code** | **Comments** |
| [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) | Coding.system | Coding.code |  |
| [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept) | CodeableConcept.coding.system | CodeableConcept.coding.code | Matches against any coding in the CodeableConcept |
| [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) | Identifier.system | Identifier.value |  |
| [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) | ContactPoint.use | ContactPoint.value | The use is prepended by [http://hl7.org/fhir/contact-point-system](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-contact-point-system.html)/ |
| [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) | (implicit) | code | the system is defined in the value set (though it's not usually needed) |
| [boolean](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#boolean) | (implicit) | boolean | The implicit system is [http://hl7.org/fhir/special-values](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-special-values.html) |
| [string](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#string) | n/a | string | Token is sometimes used for string to indicate that exact matching is the correct default search stategy |

Note about the use of token search parameters for boolean fields: the boolean values 'true' and 'false' are also represented as formal codes in the [Special Values](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-special-values.html) code system, which is useful when boolean values need to be represented in a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#coding) data type. The namespace for these codes is http://hl7.org/fhir/special-values, though there is usually no reason to use this, as a simple true or false is sufficient.

**Modifiers:**

|  |  |
| --- | --- |
| **Modifier** | **Use** |
| :text | the search parameter is processed as a string that searches text associated with the code/value - either *CodeableConcept.text*, *Coding.display*, or *Identifier.type.text* |
| :not | reverse the code matching described in the paragraph above |
| :above | the search parameter is a concept with the form [system]|[code], and the search parameter tests whether the coding in a resource subsumes the specified search code (e.g. the search concept has an is-a relationship with the coding in the resource, and this includes the coding itself) |
| :below | the search parameter is a concept with the form [system]|[code], and the search parameter tests whether the coding in a resource is subsumed by the specified search code (e.g. the coding in the resource has an is-a relationship with the search concept, and this includes the coding itself) |
| :in | the search parameter is a URI (relative or absolute) that identifies a value set, and the search parameter tests whether the coding is in the specified [value set](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html). The reference may be literal (to an address where the value set can be found) or logical (a reference to ValueSet.url) - if the server can treat the reference as a literal URL, it does, else it tries to match known logical ValueSet.url values |
| :not-in | the search parameter is a URI (relative or absolute) that identifies a value set, and the search parameter tests whether the coding is not in the specified value set |

Most servers will only process value sets that are already known/registered/supported internally, but servers can elect to accept any valid reference to a value set. Servers may elect to consider concept mappings when testing for subsumption relationships.

Here are some example searches:

|  |  |
| --- | --- |
| **Search** | **Description** |
| GET [base]/Patient?identifier=http://acme.org/patient|2345 | Search for all the patients with an identifier with key = "2345" in the system "http://acme.org/patient" |
| GET [base]/Patient?gender=male | Search for any patient with a gender that has the code "male" |
| GET [base]/Patient?gender:not=male | Search for any patient with a gender that does not have the code "male" |
| GET [base]/Patient?active=true | Search for any patients that are active |
| GET [base]/Condition?code=http://acme.org/conditions/codes|ha125 | Search for any condition with a code "ha125" in the code system "http://acme.org/conditions/codes" |
| GET [base]/Condition?code=ha125 | Search for any condition with a code "ha125". Note that there is not often any useful overlap in literal symbols between code systems, so the previous example is generally preferred |
| GET [base]/Condition?code:text=headache | Search for any Condition with a code that has a text "headache" associated with it (either in the text, or a display) |
| GET [base]/Condition?code:in=http://snomed.info/sct?fhir\_vs=isa/126851005 | Search for any condition in the SNOMED CT value set that includes all descendents of "Neoplasm of liver" |
| GET [base]/Condition?code:below=126851005 | Search for any condition that is subsumed by the SNOMED CT Code "Neoplasm of liver". Note: this is the same outcome as the previous search |
| GET [base]/Condition?code:in=http://acme.org/fhir/ValueSet/cardiac-conditions | Search for any condition that is in the institutions list of cardiac conditions |

#### quantity

A quantity parameter searches on the [Quantity](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\datatypes.html" \l "Quantity) data type. The syntax for the value follows the form:

* **[parameter]=[prefix][number]|[system]|[code]** matches a quantity with the given unit

The prefix optional, and is as described [above](#prefix), both regarding how precision and comparator/range operators are interpreted. Example searches:

|  |  |
| --- | --- |
| **Search** | **Description** |
| GET [base]/Observation?value=5.4|http://unitsofmeasure.org|mg | Search for all the observations with a value of 5.4 mg where mg is understood as a UCUM unit (system/code) |
| GET [base]/Observation?value=5.4||mg | Search for all the observations with a value of 5.4 mg where the units - either the code or the stated human units (units) are "mg" |
| GET [base]/Observation?value=le5.4|http://unitsofmeasure.org|mg | Search for all the observations where the value of is less than 5.4 mg where mg is understood as a UCUM unit |
| GET [base]/Observation?value=ap5.4|http://unitsofmeasure.org|mg | Search for all the observations where the value of is about 5.4 mg where mg is understood as a UCUM unit |

The search processor may choose to perform a search based on [canonical units](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#quantity) (e.g. any value where the units can be converted to a value in mg in the case above)

#### reference

A reference parameter refers to [references between resources](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\references.html), e.g. find all Conditions where the subject reference is a particular patient, where the patient is selected by name or identifier. The interpretation of a *reference* parameter is either:

* **[parameter]=[id]** the logical [id] of a resource using a local reference (i.e. a relative reference)
* **[parameter]=[type]/[id]** the logical [id] of a resource of a specified type using a local reference (i.e. a relative reference), for when the reference can point to different types of resources (e.g. [Observation.subject](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\observation-definitions.html#Observation.subject))
* **[parameter]=[url]** where the [url] is an absolute URL - a reference to a resource by its absolute location

Note that if a relative reference resolves to the same value as a specified absolute URL, or vice versa, this is a match too. For example, if the search parameter value is Patient/123, then this will find references like this:

<patient>

<reference value="Patient/123"/>

</patient>

If the server base address is http://example.org/fhir, then the full URL for that reference is http://example.org/fhir/Patient/123, which means that the search term also matches patient references like this:

<patient>

<reference value="http://example.org/fhir/Patient/123"/>

</patient>

In addition, searching for reference=http://example.org/fhir/Patient/123 will also match both references.

Some references are allowed to point to more than one type of resource. e.g. subject : Reference(Patient|Group|Device|..). In these cases, multiple different resources may have the same logical identifier. Servers SHOULD reject a search where the logical id refers to more than one matching resource across different types. In order to allow the client to perform a search in these situations can specify the type explicitly:

GET [base]/Condition?subject=Patient/23

This searches for any conditions where the subject refers to the patient resource with the logical identifier "23". A modifier is also defined to to allow the client to be explicit about the intended type:

GET [base]/Condition?subject:Patient=23

This has the same effect as the previous search. The modifier becomes useful when used with chaining as in explained in the next section. Note that the [type] modifier can't be used with a reference to a resource found on another server, since the server would not usually know what type that resource has (but since these are absolute references, there can be no ambiguity about the type).

#### Chained parameters

In order to save a client from doing a series of search operations, reference parameters may be "chained" by appending them with a period (.) followed by the name of a search parameter defined for the target resource. This can be done recursively, following a logical path through a graph of related resources, separated by ".". For instance, given that the resource [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) has a search parameter named *subject*, which is usually a reference to a [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource, and the Patient resource includes a parameter *name* which searches on patient name, then the search

GET [base]/DiagnosticReport?subject.name=peter

is a request to return all the lab reports that have a subject whose name includes "peter". Because the Diagnostic Report subject can be one of a set of different resources, it's necessary to limit the search to a particular type:

GET [base]/DiagnosticReport?subject:Patient.name=peter

Which is a request to return all the lab reports that have a subject which is a patient, whose name includes "peter".

Advanced Search Note: Where a chained parameter searches a resource reference that may have more than one different type of resource as its target, the parameter chain may end up referring to search parameters with the same name on more than one kind of resource at once. Servers SHOULD reject a search where the logical id refers to more than one matching resource across different types (e.g. the client has to specify the type explicitly using the syntax in the second example above).

#### Composite Search Parameters

Composite search parameters supports joining single values with a "$". For example, the result of the search operation is the intersection of the resources that match the criteria specified by each individual search parameter. If a parameter repeats, such as /Patient?language=FR&language=NL, then this matches a patient who speaks both languages. This is known as an AND search parameter, since the server is expected to respond only with results which match both values.

If, instead, the search is to find patients that speak either language, then this is a single parameter with multiple values, separated by a ','. For example: "/Patient?language=FR,NL". This is known as an OR search parameter, since the server is expected to respond with results which match either value.

AND parameters and OR parameters may also be combined, for example: "/Patient?language=FR,NL&language=EN" would refer to any patient who speaks English as well as either French or Dutch.

This allows for simple combinations of and/or values, but doesn't allow a search based on a pair of values, such as all observations with a sodium value >150 mmol/L (particularly as the end criteria of a chained search), or searching on Group.characteristic: you need find a combination of key/value, not an intersection of separate matches on key and value. Another example is spatial coordinates when doing geographical searches.

To allow these searches, a resource may also specify *composite* parameters that take sequences of single values that match other defined parameters as an argument. The matching parameter of each component in such a sequence is documented in the definition of the parameter. These sequences are formed by joining the single values with a "$". Note that this sequence is a single value and itself can be composed into a set of values, so that, for example, multiple matching state-on-date parameters can be specified as state-on-date=new$2013-05-04,active$2013-05-05.

Modifiers are not used on composite parameters.

Examples of using composite parameters:

|  |  |
| --- | --- |
| **Search** | **Description** |
| GET [base]/DiagnosticReport?result.code-value-quantity=http://loinc.org|2823-3$gt5.5|http://unitsofmeasure.org|mmol/L | Search for all diagnostic reports that contain on observation with a potassium value of >5.4 mmol/L (UCUM) |
| GET [base]/Observation?component-code-value-quantity=http://loinc.org|8480-6$lt60 | Search for all the observations with a systolic blood pressure < 60. Note that in this case, the units are assumed (eveyone uses mmHg) |
| GET [base]/Group?characteristic-value=gender$mixedSearch for all groups that have a characteristic 'gender' with a text value of 'mixed' |  |

#### Escaping Search Parameters

In the rules above, special rules are defined for the characters "$", ",", and "|". As a consequence, if these characters appear in an actual parameter value, they must be differentiated from their use as separator characters. When any of these characters appear in an actual parameter value, they must be prepended by the character "\" (which also must be used to prepend itself). So "param=xxx$xxx" means a composite parameter, while "param=xx\$xx" means that the parameter has the literal value 'xx$xx'. The parameter value "xx\xx" is illegal, and the parameter value "param=xx\\xx" means a literal value of 'xx\xx'.

This specification defines this extra form of escape for a reason. The classic %xx escaping which is part of normal HTTP URLs makes sure the character ends up at the FHIR server correctly, while the "," versus "\" becomes important once it has reached the server and the query is parsed. So:

GET [base]/ValueSet?url=http://acme.org/fhir/ValueSet/123,http://acme.org/fhir/ValueSet/124%2CValueSet/125

uses url escaping to make sure the FHIR server received:

GET [base]/ValueSet?url=http://acme.org/fhir/ValueSet/123,http://acme.org/fhir/ValueSet/124,125

This means that the server is comparing the url against 3 values (the last one being a relative (and wrong) url, which is probably not the actual intent). However:

GET [base]/ValueSet?url=http://acme.org/fhir/ValueSet/123,http://acme.org/fhir/ValueSet/124\,125

which is equivalent to:

GET [base]/ValueSet?url=http://acme.org/fhir/ValueSet/123,http://acme.org/fhir/ValueSet/124\%2C125

which would mean: url = "http://.....123" OR "http://....124,125".

#### Text Search Parameters

There are two special text search parameters, \_text and \_content, which search on the narrative of the resource, and the entire content of the resource respectively. These parameters SHOULD support a sophisticated search functionality of the type offered by typical text indexing services is appropriate. The value of the parameter is a text based search, which may involve searching multiple words with thesaurus and proximity considerations, and logical operations such as AND, OR etc. For example:

GET [base]/Condition?\_text=(bone OR liver) and metastases

This searches for all Condition resources with the word "metastases" and either "bone" or "liver" in the narrative. The server MAY choose to search for related words as well.

**DSTU Note:** The issues around standardizing text search are not fully resolved. During the trial use period for this specification, we recommend that systems use the rules specified by [the OData specification for the $search parameter](http://docs.oasis-open.org/odata/odata/v4.0/cs01/part1-protocol/odata-v4.0-cs01-part1-protocol.html#_The_$search_System). Typical implementations would use Lucene, an sql-based full text search, or some indexing service.

Feedback is welcome [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

#### Searching by list

The \_list parameter allows for the retrieval of resources that are referenced by a [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html) resource.

GET [base]/Patient?\_list=42

This returns all patient resources that are referenced from the list found at [base]/List/42) in List.entry.item. While it is possible to retrieve the list, and then iterate the entries in the list fetching each patient, using a list as a search criteria allows for additional search criteria to be specified. For instance:

GET [base]/Patient?\_list=42&gender=female

which means, welect all the female patients in the list. The server can return the list referred to in the search parameter as an included resource, but is not required to do so. In addition, a system can support searching by lists by their logical function. For example:

GET [base]/AllergyIntolerance?patient=42&\_list=$current-allergies

This is a request to fetch all the allergies in the patient 42's "Currrent Allergy List". The server returns all the relevant AllergyIntolerance resources, and can also choose to return the list. For further information, refer to the [definition of "$current-allergies"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\lifecycle.html#current), and the [List Operation "Find"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list-operations.html#find). Note that servers are not required to make these lists available to the clients as list resources, but may choose to do so.

#### Advanced filtering

The search mechanism described above is flexible, and easy to implement for simple cases, but it is limited in its ability to express combination queries. To complement this mechanism, a specific search expression parameter can also be used, named "\_filter".

For example, this is a moderately simple search: find all the observations for patient with a name including "peter" that have a LOINC code 1234-5:

GET [base]/Observation?name=http://loinc.org|1234-5&subject.name=peter

Using the \_filter parameter, the search would be expressed like this:

GET [base]/Observation?\_filter=name eq http://loinc.org|1234-5 and subject.name co "peter"

The \_filter parameter is described in detail on the ["\_Filter Parameter" page](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search_filter.html).

### Managing Returned Resources

#### Sorting

The client can indicate which order to return the results in using the parameter "\_sort", which can have a value of one of the search parameters. The \_sort parameter can repeat to indicate sort order, with the repeats indicating a lower sort priority sequentially.

The \_sort parameter takes one of two qualifiers, ":asc" and ":desc", which specify ascending and descending sort order respectively. The default value is ":asc".

Notes:

* When sorting, the actual sort value used is not returned explicitly by the server for each resource, just the resource contents
* To sort by relevance, use "\_sort:asc=\_score"
* The server returns the sort it performs as part of the returned search parameters (see [below](" \l "conformance))
* A search parameter can refer to an element that repeat, and therefore there can be multiple values for a given search parameter for a single resource. In this case, the sort is based on the item in the set of multiple parameters that comes earliest in the specified sort order when ordering the returned resources.
* When sorting on string search parameters, sorting SHOULD be performed on a case-insensitive basis. Accents may either be ignored or sorted as per realm convention. Note: Consistency of sorting across servers isn't as essential as consistency of filtering (even that is variable). The purpose of sorting is to provide data in a "reasonable" order for end users. "Reasonable" may vary by realm, particularly for accented characters.

#### Page Count

In order to keep the load on clients, servers and the network minimized, the server may choose to return the results in a series of pages. The search result set contains the URLs that the client uses to request additional pages from the search set. For a simple RESTful search, the page links are [contained in the returned bundle as links](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#paging).

Typically a server will provide its own parameters in the links that it uses to manage the state of the search as pages are retrieved. These parameters do not need to be understood or processed by the client.

The parameter \_count is defined as a hint to the server regarding how many resources should be returned in a single page. Servers SHALL NOT return more resources than requested (even if they don't support paging) but are allowed to return less than the client asked for. The server should repeat the original \_count parameter in its returned page links so that subsequent paging requests honour the original \_count. Note that it is at the discretion of the search engine how to handle ongoing updates to the resources while the search is proceeding.

Note that the combination of \_sort and \_count can be used to return just the latest resource that meets a particular criteria - set the critera, and then sort by date in descending order, with \_count=1. This way, the last matching resource will be returned.

#### Including other resources in result (\_include and \_revinclude)

Clients may request that the engine return additional resources related to the search results, in order to reduce the overall network delay of repeated retrievals of related resources. A typical case where this is useful is where the client is searching on some type of clinical resource, but for every such resource returned, the client will also need the subject (patient) resource that the clinical resource refers to. The client can use the \_include parameter to indicate that the subject resources be included in the results. An alternative scenario is where the client wishes to fetch a particular resource, and any resources that refer to it. For example, the client may wish to fetch a MedicationOrder, and any provenance resources that refer to the prescription. This is known as a reverse include, and specified by providing a \_revinclude parameter.

Both \_include and \_revinclude are based on search parameters, rather than paths in the resource, since joins (e.g. [chaining](#chaining) are already done by search parameter.

Each \_include parameter specifies a search parameter to join on:

GET [base]/MedicationOrder?\_include=MedicationOrder:patient&criteria...

GET [base]/MedicationOrder?\_revinclude=Provenance:target&criteria...

The first search means, for any matching MedicationOrder, include any patient that the medication prescriptions in the result set refer to. The second search means, for any matching prescriptions, return all the provenance resources that refer to them.

Parameter values for both \_include and \_revinclude have 3 parts, separated by a ":" separator:

1. The name of the source resource from which the join comes
2. The name of the search parameter which must be of type *reference*
3. (Optional) A specific of type of target resource (for when the search parameter refers to multiple possible target types)

\_include and \_reverseInclude parameters do not include multiple values. Instead, the parameters are repeated for each different include criteria.

For each returned resource, the server identifies the resources that meet the criteria expressed in the join, and adds to the results, with the [entry.status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.entry.status) set to "include" (in some searches, it is not obvious which resources are matches, and which are includes).

The inclusion process can be recursive, if the modifier :recurse is included. For example, this example search returns all the [Medication Prescription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationorder.html) resources and their [prescribing Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html) Resources for the matching [Medication Dispense](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\medicationdispense.html) resources:

GET [base]/MedicationDispense?\_include=MedicationDispense.authorizingPrescription

&\_include:recurse=MedicationOrder.prescriber&criteria...

This technique applies to circular relationships as well. For example, the first of these two searches includes any related observations to the target relationships, but only those directly related. The second search asks for the \_include based on related parameter to be executed recursively, so will retrieve observations that are directly related, and also any related observations to any other included observation.

GET [base]/Observation?\_include=Observation.related-target&criteria...

GET [base]/Observation?\_include:recurse=Observation.related-target&criteria...

Both \_include and \_reverseInclude and use the wild card "\*" for the search parameter name, indicating by this that any search parameter of type=reference be included, though though both clients and servers need to take care not to request or return too many resources when doing this. Most notably, using recursive inclusions might lead to the retrieval of the full patient's record, or even more: resources are organized into an interlinked network and broad \_include paths may eventually traverse all possible paths on the server. For servers, these recursive and wildcard \_includes are demanding and may slow the search response time significantly.

It is at the server's discretion how deep to recursively evaluate the inclusions. Servers are expected to limit the number of iterations done to an appropriate level and are not obliged to honor requests to include additional resources in the search results.

When the search results are paged, each page of search results should include the matching includes for the resources in each page, so that each page stands alone as a coherent package.

#### Contained Resources

By default, search results only include resources that are not contained in other resources. A chained condition will be evaluated inside contained resources. To illustrate this, consider a MedicationOrder resource that has a contained Medication resource specifying a custom formulation that has ingredient that has a value Substance/x23. In this case, a search:

GET MedicationOrder?medication.ingredient=Substance/x23

will include the MedicationOrder resource in the results. However this search:

GET Medication?ingredient=Substance/x23

will not include the contained Medication resource in the results, since either the wrong type of resource would be returned, or the contained resource would be returned without its container resource, which provides context to the contained resource.

Clients are able to modify this behavior using the \_contained parameter, which can have one of the following values:

* false (default): Do not return contained resources
* true: return only contained resources
* both: return both contained and non-contained (normal) resources

When contained resources are being returned, the server should return either the container resource, or the contained resource alone. The client can specify which by using the \_containedType parameter, which can have one of the following values:

* container (default): Return the container resources
* contained: return only the contained resource

When returning a container resource, the server simply puts this in the search results:

<Bundle>

...

<entry>

<resource>

<MedicationOrder>

<id value="23">

....

<contained>

<Medication>

<id value="m1">

...

</Medication>

<contained>

</MedicationOrder>

</resource>

<search>

<mode value="match"/>

</search>

</entry>

</Bundle>

In the case of returning container resources, the server SHALL populate the entry.search.mode element so that the client can pick matches and includes apart (the usual approach of doing it by type may not work). If the return type is the contained resource, this must be done slightly differently:

<Bundle>

...

<entry>

<fullUrl value="http://example.com/fhir/MedicationOrder/23#"/>

<resource>

<Medication>

<id value="m1">

...

</Medication>

</resource>

<search>

<mode value="match"/>

</search>

</entry>

</Bundle>

In this case, the fullUrl informs the client that this is a contained resource, and the identity of the containing resource.

#### External References

If the \_include path selects a reference that refers to a resource on another server, the server can elect to include that resource in the search results for the convenience of the client.

If the \_include path selects a reference that refers to an entity that is not a Resource (e.g. an image attachment), the server may also elect to include this in the returned results as a [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#binary) resource. For example, the include path may point to an attachment which is by reference, like this:

<content>

<contentType>image/jpeg</contentType>

<url>http://example.org/images/2343434/234234.jpg</url>

</content>

The server can retrieve the target of this reference, and add this to the results for the convenience of the client.

**DSTU Note:** Should additional rules about how \_include works be made?

Feedback based on implementation experience is sought [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

#### Paging

When returning paged results for a search with \_include resources, all \_include resources that are related to the primary resources returned for the page SHOULD also be returned as part of that same page, even if some of those resource instances have previously been returned on previous pages. This allows both sender and receiver to avoid caching results of other pages.

#### Summary

The client can request the server to return a portion of the resources only using the parameter "\_summary":

GET [base]/ValueSet?\_summary=true

The *\_summary* parameter requests the server to return only a subset of the resource. It can have one of the following values:

|  |  |
| --- | --- |
| [true](#summary-true) | Return only those elements marked as 'summary' in the base definition of the resource(s) |
| [text](#summary-text) | Return only the 'text' element, and any mandatory elements |
| [data](#summary-data) | Remove the text element |
| [count](#summary-count) | Search only: just return a count of the matching resources, without returning the actual matches |
| [false](#summary-false) | Return all parts of the resource(s) |

The intent of the \_summary parameter is to reduce the total processing load on server, client, and resources between them such as the network. It is most useful for resources that can be large, particularly ones that include images or elements that may repeat many times. The purpose of the summary from is to allow a client to quickly retrieve a large set of resources, and let a user pick the appropriate one. The summary for an element is defined to allow a user to quickly sort and filter the resources, and typically omit important content, on the basis that the entire resource will be retrieved when the user selects a resource.

Servers are not obliged to return just a summary as requested. There is only a limited number of summary forms defined for resources in order to allow servers to store the summarized form(s) in advance. Servers SHOULD mark the resources with the tag [SUBSETTED](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\SecurityIntegrityObservationValue\index.html#SUBSETTED) to ensure that the incomplete resource is not acidentally used to overwrite a complete resource.

#### Elements

If one of the summary views defined above is not appropriate, a client can request a specific set of elements be returned as part of a resource using the \_elements parameter:

GET [base]/Patient?\_elements=identifier,active,link

The \_elements parameter consists of a comma separated list of base element names (e.g. elements defined at the root level in the resource). Only elements that are listed are to be returned. Clients SHOULD list all mandatory elements in a resource as part of the list of elements. The list of elements does not apply to [included resources](#include).

Servers are not obliged to return just the requested elements. Servers SHOULD always return mandatory elements whether they are requested or not. Servers SHOULD mark the resources with the tag [SUBSETTED](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\SecurityIntegrityObservationValue\index.html#SUBSETTED) to ensure that the incomplete resource is not actually used to overwrite a complete resource.

#### Relevance

Where a search specifies a non-deterministic sort, the search algorithm may generate some kind of ranking score to indicate which resources meet the specified criteria better than others. The server can return this score in [entry.score](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle-definitions.html#Bundle.entry.score):

<entry>

<score value=".45"/>

<Patient>

... patient data ...

</Patient>

</entry>

The score is a decimal number with a value between (and including) 0 and 1, where 1 is best match, and 0 is least match.

### Server Conformance

In order to allow the client to be confident about what search parameters were used as a criteria by the server, the server SHALL return the parameters that were actually used to process the search. Applications processing search results SHALL check these returned values where necessary. For example, if the server did not support some of the filters specified in the search, a client might manually apply those filters to the retrieved result set, display a warning message to the user or take some other action.

In the case of a RESTful search, these parameters are encoded in the self link in the bundle that is returned:

<link>

<relation value="self"/>

<url value="http://example.org/Patient?name=peter"/>

</link>

In other respects, servers have considerable discretion with regards to supporting search:

* Servers can choose which parameters to support (other than \_id above)
* Servers can choose when and where to implement parameter chaining, and when and where they support the \_include parameter
* Servers are able to declare additional parameters in the profiles referenced from their conformance statements. Servers should define search parameters starting with a "-" character to ensure that the names they choose do not clash with future parameters defined by this specification
* Servers are not required to enforce case sensitivity on parameter names, though the names are case sensitive (and URLs are generally case-sensitive)
* Servers may choose how many results to return, though the client can use \_count as above
* Servers can choose how to sort the return results, though they SHOULD honor the \_sort parameter

### Advanced Search

The search framework described above is a useful framework for providing a simple search based on indexed criteria, but more sophisticated query capability is needed to handle precise queries, complex decision support based requests, and direct queries that have human resolution.

More advanced search operations are specified by the \_query parameter:

GET [base]/Patient?\_query=name&parameters...

The \_query parameter names a custom search profile that describes a specific query operation. The named query may define additional named parameters that are used with that particular named query. Servers can define their own additional named queries to meet their own uses using a [OperationDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationdefinition.html).

There can only ever be one \_query parameter in a set of search parameters. Servers processing search requests SHALL refuse to process a search request if they do not recognize the \_query parameter value.

### Search Result Currency

The results of a search operation are only guaranteed to be current at the moment the operation is executed. After the operation is executed, ongoing actions performed on the resources against which the search was executed will render the results increasingly stale. The significance of this depends on the nature of the search, and the kind of use that is being made of the results.

This is particularly relevant when the server is returning the results in a series of pages. It is at the discretion of the search engine how to handle ongoing updates to the resources while the search is proceeding.

Note that performing a search operation does not change the set of resources on the server, with the exception of the creation of [Audit Event](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resources auditing the search itself.

### Summary Tables

|  |  |  |  |
| --- | --- | --- | --- |
| Common Parameters defined for all resources: | | | |
| **Name** | **Type** | **Description** | **Paths** |
| [\_id](#id) | [string](#string) | Resource id (not a full URL) | Resource.id |
| [\_lastUpdated](#lastUpdated) | [date](#date) | Date last updated. Server has discretion on the boundary precision | Resource.meta.lastUpdated |
| [\_tag](#tag) | [token](#token) | Search by a resource tag | Resource.meta.tag |
| [\_profile](#profile) | [uri](#uri) | Search for all resources tagged with a profile | Resource.meta.profile |
| [\_security](#security) | [token](#token) | Search by a security label | Resource.meta.security |
| [\_text](#text) | [string](#string) | Text search against the narrative |  |
| [\_content](#content) | [string](#string) | Text search against the entire resource |  |
| [\_list](#list) | [string](#string) | All resources in nominated list (by id, not a full URL) |  |
| [\_query](#query) | [string](#string) | Custom named query |  |
| Search Control Parameters: | | | |
| **Name** | **Type** | **Description** | **Allowable Content** |
| [\_sort](#sort) | [string](#string) | Order to sort results in (can repeat for inner sort orders) | The name of a valid search parameter |
| [\_count](#count) | [number](#number_) | Number of results per page | Whole Number |
| [\_include](#include) | [string](#string) | Other resources to include in the search results that search matches point to | SourceType:searchParam(:targetType) |
| [\_revinclude](#revinclude) | [string](#string) | Other resources to include in the search results when they refer to search matches | SourceType:searchParam(:targetType) |
| [\_summary](#summary) | [string](#string) | Just return the summary elements (for resources where this is defined) | true | false (false is default) |
| [\_contained](#contained) | [string](#string) | Whether to return resources contained in other resources in the search matches | true | false | both (false is default) |
| [\_containedType](#containedType) | [string](#string) | If returning contained resources, whether to return the contained or container resources | container | contained |

Cross-map between search parameter types and Data types:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Data Type** | [**number**](#number) | [**date**](#date) | [**string**](#string) | [**token**](#token) | [**reference**](#reference) | [**quantity**](#quantity) | [**uri**](#uri) |
| [boolean](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#boolean) |  |  |  | . true|false (System = http://hl7.org/fhir/special-values but not usually needed) |  |  |  |
| [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) |  |  |  | . (System, if desired, is defined in the underlying value set for eeach code) |  |  |  |
| [date](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#date) |  |  |  |  |  |  |  |
| [dateTime](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dateTime) |  |  |  |  |  |  |  |
| [instant](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#instant) |  |  |  |  |  |  |  |
| [integer](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#integer) |  |  |  |  |  |  |  |
| [string](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#string) |  |  |  |  |  |  |  |
| [uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri) |  |  |  |  |  |  |  |
| [Address](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Address) |  |  | search on any elements in the address |  |  |  |  |
| [Annotation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Annotation) |  |  |  |  |  |  |  |
| [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept) |  |  |  |  |  |  |  |
| [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) |  |  |  |  |  |  |  |
| [ContactPoint](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#ContactPoint) |  |  |  |  |  |  |  |
| [Duration](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Duration) |  |  |  |  |  |  |  |
| [HumanName](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#HumanName) |  |  | Search on any element in the name |  |  |  |  |
| [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) |  |  |  |  |  |  |  |
| [Period](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Period) |  |  |  |  |  |  |  |
| [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity) |  |  |  |  |  |  |  |
| [Range](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Range) |  |  |  |  |  |  |  |
| [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Reference) |  |  |  |  |  |  |  |
| [SampledData](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#SampledData) |  |  |  |  |  |  |  |
| [Timing](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Timing) |  |  |  |  |  |  |  |

# search\_filter.html

### \_filter Parameter

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

#### Introduction

The \_filter parameter is a parameter that can be used with the [Search Operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html). It uses the same set of standard parameters defined for the resources, and provides a syntax for expressing a set of query expressions on the underlying resources.

Here's some example filters:

* Patient: name co "pet" - all patients with the characters "pet" in a given or family name
* Patient: given eq "peter" and birthdate ge 2014-10-10 - all patients with a given name of peter, born on or after 10-Oct 2014
* Observation: name eq http://loinc.org|1234-5 - all observations with the loinc code "1234-5"
* Observation: subject.name co "pet" - all observations on a patient with the characters "pet" in a given or family name
* Observation: related[type eq "has-component"].target pr true - all observations that have component observations (note: this uses one of the search parameters defined for this mechanism, see below)
* Observation: related[type eq has-component].target re Observation/4 - all observations that have Observation/v as a component

The \_filter syntax has the following features:

* A filter can be a logical one (x or x, or x and x, or not x)
* A filter can contain other filters in a set of parentheses : "()"
* A filter can be a test - path operation value, where operation is taken from the table below, and value is either a "true", "false", a JSON string, or a token (any sequence of non-whitespace characters, excluding ")" and "]". Values are never case sensitive
* A 'path' is a name, with chained searches done by name.name etc as per existing source. There can also be a filter: name[filter].name...
* The name is one of the defined search parameters that are used with the other search mechanism, with some special exemptions defined below.

Note that the only difference between a "string" value and a "token" value is that a string can contain spaces and ) and ]. There is otherwise no significant difference between them.

This is the formal grammar for the syntax:

filter = paramExp / logExp / ("not") "(" filter ")"

logExp = filter ("and" / "or" filter)+

paramExp = paramPath SP compareOp SP compValue

compareOp = (see table below)

compValue = string / numberOrDate / token

string = json string

token = any sequence of non-whitespace characters (by Unicode rules) except "]" and ")"

paramPath = paramName (("[" filter "]") "." paramPath)

paramName = ALPHA (nameChar)\*

nameChar = "\_" / "-" / DIGIT / ALPHA

numberOrDate = DIGIT (DateChar)\*

dateChar = DIGIT / "T" / "-" / "." / "+"

Notes about using the syntax:

* Logical expressions are evaluated left to right, with no precedence between "and" and "or". If there is ambiguity, use parentheses to be explicit
* the compareOp is always evaluated against the set of values produced by evaluating the param path
* the parameter names are those defined by the specification for search parameters, except for those defined below
* the date format is a standard XML (i.e. XSD) dateTime (including timezone).

#### Operators

This table summarises the comparison operations available:

|  |  |
| --- | --- |
| Operation | Definition |
| eq | an item in the set has an equal value |
| ne | An item in the set has an unequal value |
| co | An item in the set contains this value |
| sw | An item in the set starts with this value |
| ew | An item in the set ends with this value |
| gt / lt / ge / le | A value in the set is (greater than, less than, greater or equal, less or equal) the given value |
| ap | A value in the set isis approximately the same as this value. Note that the recommended value for the approximation is 10% of the stated value (or for a date, 10% of the gap between now and the date), but systems may choose other values where appropriate |
| sa | The value starts after the specified value |
| eb | The value ends before the specified value |
| pr | The set is empty or not (value is false or true) |
| po | True if a (implied) date period in the set overlaps with the implied period in the value |
| ss | True if the value subsumes a concept in the set |
| sb | True if the value is subsumed by a concept in the set |
| in | True if one of the concepts is in the nominated value set by URI, either a relative, literal or logical vs |
| ni | True if none of the concepts are in the nominated value set by URI, either a relative, literal or logical vs |
| re | True if one of the references in set points to the given URL |

For detailed rules about the operators eq, ne, le, ge, lt, gt, sa, and eb see [Search Prefixes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#prefix).

The interpretation of the operation depends on the type of the search parameter it is being evaulated against. This table contains those details:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operation | String | Number | Date | Token | Reference | Quantity |
| Eq | Character sequence is the same (case insensitive) | Number is the same incl same precision | Date is the same including same precision and timezone if provided | Token is the same, including namespace if specified (case insensitive) | n/a | Unit and value are the same |
| Ne | (same) | | | | | |
| Co | Character sequence matches somewhere (case insensitive) | An item in the set's implicit imprecision includes the stated value | An item in the set's implicit period includes the stated value | n/a | n/a | n/a? |
| Sw | Character sequence matches from first digit (left most, when L->R) (case insensitive) | n/a | n/a | n/a | n/a | n/a |
| ew | Character sequence matches up to last digit (right most, when L->R) (case insensitive) | n/a | n/a | n/a | n/a | n/a |
| gt / lt / ge / le | Based on Integer comparison of Unicode code points of starting character (trimmed) (case insensitive) | Based on numerical comparison | Based on date period comparison per 2.2.2.3 | n/a | n/a | Based on numerical comparison if units are the same (or are canonicalised) |
| pr |  |  |  |  |  |  |
| po | n/a | n/a | Based on date period comparison per 2.2.2.3 |  | n/a | n/a |
| ss | n/a | n/a | n/a | Based on logical subsumption; potentially catering for mapping between tx | n/a | n/a |
| sb | n/a | n/a | n/a | Based on logical subsumption; potentially catering for mapping between tx | n/a | n/a |
| in | n/a | n/a | n/a | Based on logical subsumption; potentially catering for mapping between tx | n/a | n/a |
| re | n/a | n/a | n/a | n/a | Relative or absolute url | n/a |

Notes:

* For token, the format is the same as the existing search parameter
* For convenience, the codes "loinc", "snomed", "rxnorm" and "ucum" are predefined and can be used in place of their associated full namespace

#### Additional Parameters

Some additional parameters are defined for the filter parameter (*to do: move these into the standard parameters*):

|  |  |  |
| --- | --- | --- |
| Resource Type | Parameter Name | Children |
| Observation | related | target = related-target  Type = related-type |
| Group | characteristic | value = value  code = characteristic |
| DocumentReference | relatesTo | code = relation  target = relatesTo |
| DiagnosticOrder | event | status = event-status date = event-date |
| DiagnosticOrder | item | status = item-status  code = item-code  site = bodysite  event = item-event |
| DiagnosticOrder | item-event | status = item-past-status date = item-date actor = actor |

Explanation:

* Any time these names are used in a parameter, they must have a filter and a chained name under them
* The first column is the resource type against which this name can be used
* The second column is the prameter name that is used
* The third column defines the names that can be used in the chained parameter, and in the filter, and shows which existing search parameters they equate to
* For example, you could search on Observation for '\_filter=related[type eq has-component].target re url'. "type" here refers to the search parameter "related-type", and "target" to the search parameter "related-target"

# security-labels.html

# Security Labels

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

A security label is a [concept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) attached to a resource or bundle that provides specific security metadata about the information it is fixed to. The [Access Control decision engine](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#access-control) uses the security label together with any provenance resources associated with the resource and other metadata (e.g. the resource type, resource contents, etc.) to

* approve read, change, and other operations
* determine what level of the resource can be returned
* determine what handling caveats must be conveyed with the data

Security Labels enable more data to flow as they enable policy fragments to accompany the resource data.

The intent of a security label is that the recipient of resources or bundles with security-tags is obligated to enforce the handling caveats of the tags and carry the security labels forward as appropriate.

Security labels are only a device to connect specific resources, bundles, or operations to a wider security framework; a full set of policy and consent statements and their consequent obligations is needed to give the labels meaning. As a consequence of this, security labels are most effective in fully trusted environments - that is, where all trading partners have agreed to abide by them in a Mutual Trust Framework. Note also that security labels support policy, and specific tagging of individual resources is not always required to implement policy correctly.

In the absence of this kind of pre-agreement, Security Labels may still be used by individual parties to assist with security role checking, but they may not all be recognized and enforced, which in turn limits what information is allowed to flow.

Local agreements and implementation profiles for the use security labels should describe how the security labels connect to the relevant consent and policy statements, and in particular:

* Which Security Labels are able to be used
* What do if a resource has an unrecognized security label on it
* Authoring obligations around security labels
* Operational implications of security labels

This specification defines a basic set of labels for the most common use cases trading partners, and also a wider array of security labels that allow much finer grained management of the information.

## Representing Security Labels

A security label is represented as a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), with the following important properties:

|  |  |
| --- | --- |
| system | The coding scheme from which label is taken (see [code system URI](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html), and below) |
| code | a code from the coding scheme that identifies the security label and code is an value from the code system |
| display | The display form for the code (mostly for use when a system doesn't recognize the code) |

An XML patient resource with a "celebrity" tag associated with it, as represented in an HTTP response:

<Patient xmlns="http://hl7.org/fhir">

<meta>

<security>

<system value="http://hl7.org/fhir/v3/ActCode"/>

<code value="CEL"/>

<display value="Celebrity"/>

</security>

</meta>

... [snip] ...

</Patient>

A JSON search result that includes a resource that the receiving application must delete all copies of the resource after using it:

{

"resourceType" : "Bundle",

"type" : "searchset",

... other headers etc ....

"entry" : [

... other entries ....

{

"resource": {

"id" : "1",

"meta" : {

"security" : [{

"system" : "http://hl7.org/fhir/v3/ActCode",

"code" : "DELAU",

"display" : "delete after use"

}]

}

... other content etc ....

}

},

... other entries ....

]

}

Note: the actual terms used in these examples are described below.

The basic framework for security labels is described by the HL7 Healthcare Classification System (HCS; ref todo). This specification identifies how security labels are defined and provides a relatively comprehensive list of labels. All of the HCS defined labels (see below for the lists) can be used as security labels on FHIR resources and bundles (e.g. requests and responses).

In addition, other security labels not defined here or in the HCS can be defined by jurisdictions, vendors and/or projects and used as appropriate. However, note that:

* Defining additional security labels will increase costs associated with information and system portability
* Implementation guides and applications SHOULD always use the applicable label defined by the HCS if one exists

Note: The use of security labels and the expression of common shared security policies is a matter of ongoing discussion and development in several communities at this time.

## Core Security Labels

This specification defines a set of core security labels for all FHIR systems. All conformant FHIR Applications SHOULD use these labels where appropriate. For all of these labels, how they are operationalised - their use and interpretation - is subject to the applicable Mutual Trust Framework agreement as described above. These codes all come from one of two code systems: http://hl7.org/fhir/v3/Confidentiality, and http://hl7.org/fhir/v3/ActCode,

|  |  |
| --- | --- |
| **Name/ Tag** | **Description** |
| **Context of Use** | |
| Confidentiality codes | These [confidentiality codes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\Confidentiality\index.html) (system = http://hl7.org/fhir/v3/Confidentiality) can be applied to any resource or bundle. They are generally assigned by the author of the resource, but can be modified subsequently as a matter of operational management. The Confidentiality codes describe the sensitivity of the information in a resource with regard to whether it should made available or disclosed to unauthorized individuals, entities, or processes.  Notes:   * In the absence of a confidentiality code, the basic confidentiality of a resource may be implied by its definition and content. e.g. a patient's condition is far more likely to be confidential than a practitioner resource, and a Diagnostic Report with an HIV test is always highly confidential, where as a routine electrolytes is rarely particularly confidential * A few resources have a confidentiality code in the resource itself. This should always be understood as the original intended confidentiality, where as a confidentiality tag is the current confidentiality of the content. e.g. the confidentiality may change in response to patient concern * The confidentiality of a bundle is always as confidential as the most confidential resource in the bundle   The additional more specific labels below are defined to support very specific fine-grained access control, and should always be used in association with an appropriate confidentiality label. |
| Celebrity / VIP: ActCode.[CEL](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#CEL) | Use on any resource to indicate that the subject/patient is a celebrity or well known to the staff in the institution.  Notes:   * This may be applied to the [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource, with implied behavior for the [entire patient compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment), or it may be applied to individual resources * Resources affected by this label are more likely to be the subject of active audit maintenance or additional security policy |
| Staff: ActCode.[EMP](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#EMP) | Use on a [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource and resources with a subject of that patient to indicate that the patient is a staff member of the institution. This is a variation on being a celebrity.  Notes:   * This may be applied to the [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource, with implied behavior for the [entire patient compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment), or it may be applied to individual resources * Resources affected by this label are (even) more likely to be the subject of active audit maintenance or additional security policy |
| Keep information from patient: ActCode.[TBOO](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#TBOO) | Used on [any](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) resource to indicate that information is not to be made available to the patient or their relatives/carers, except by the personal decision of a physician assigned to the patient.  Notes:   * A common use for this is with [Flag](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\flag.html) resources, when the alert records information on patient abuse or non-compliance * This label might also be used temporarily on laboratory or other test results where policy is for the results to be initially disclosed by direct discussion with the patient's physician |
| Contact/Employment Details Confidential: ActCode.[DEMO](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#DEMO) | Used on a [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource to indicate that the patient's address and contact details (phone numbers, email addresses) - including employment information - are sensitive and shouldn't be shared with the patient's family or others without specific authorization |
| Diagnosis-related confidentiality: ActCode.[DIA](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#DIA) | Used on [any](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourcelist.html) resource to indicate that the resource relates to a diagnosis (or potential diagnosis) which is generally associated with confidentiality requirements - or is for this particular patient. This may be associated for diagnoses including STDs, psychiatric conditions, adolescent related issues, drug abuse, genetics conditions and others.  Notes:   * Generally, this security label cascades logically; e.g. any [Diagnostic Reports](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html) produced because of a [Diagnostic Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticorder.html) with this security label should also have the same security label. * There may be additional labels classifying the diagnosis; such labels SHOULD always be accompanied by this label so that more systems will know that restrictions apply |
| Author Consent needed: ActCode.[ORCON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#ORCON) | The author's consent is needed for disclosure. Typically, this is used by a treating practitioner to label portions of their own record confidential. Any such resource is only shared with the author or with other parties as arranged. |
| **Control of Flow** | |
| Delete After Use: ActCode.[DELAU](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#DELAU) | An application receiving a resource with this label must delete all copies after the immediate use for which the resource/feed was exchanged is complete.  Notes:   * This may imply a prohibition not storing the resource in any audit trail as well * Additional security labels are allowed to make exceptions to the blanket restriction this implies. This allows a resource to be exchanged with a blanket rule not to retain copies unless the exact rules for retaining it can be followed |
| Do Not Re-use: ActCode.[NOREUSE](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActCode\index.html#NOREUSE) | An application receiving a resource with this label may only use it for the immediate purpose of use. In particular, the application is not authorized to re-distribute (i.e. exchange this resource with any other application).  Notes:   * The exact interpretation of "immediate purpose of use" and the boundaries of "the application" are determined by local policy * Additional security labels are allowed to make exceptions to the blanket restriction this implies. This allows a resource to be exchanged with a blanket rule not to re-use unless the exact rules for doing so can be followed |

## Break The Glass

There is a special security label to support the commonly encountered "break-the-glass" protocol, where a clinician (usually in an emergency context) requests emergency unauthorized access to the patient's record. This specification does not make any policy recommendations or rules about the operation, merely provides support for it. See [this paper](http://www.hl7.org/search/viewSearchResult.cfm?search_id=393442&search_result_url=%2Fdocumentcenter%2Fpublic%2Fwg%2Fsecure%2FHL7%20Emergency%20Access%2Edoc) for discussion of the issues involved in break-the-glass operations.

When the operation occurs, it is represented as a security label on the request, rather than on a resource, and so is represented differently. The break the glass tag needs to be used as part of an agreed policy and protocol. FHIR does not attempt to define this policy or protocol, it must be agreed on a implementation by implementation basis. For example as a URL:

|  |  |  |
| --- | --- | --- |
| Break The Glass | http://hl7.org/fhir/security-label#break-the-glass | The requester is asking for emergency access for patient treatment. Typically, this means that the patient is unconscious and not able to provide relevant information or consent. |

The URL is represented in the request as a [web category](https://tools.ietf.org/html/draft-johnston-http-category-header-02):

HTTP/1.1 GET fhir/Patient/482735/condition

Content-Type: text/xml

Access-Control-Allow-Origin: \*

Last-Modified: Thu, 19 Nov 2013 07:07:32 +1100

ETag: 24

Category: http://hl7.org/fhir/security-label#break-the-glass; scheme="http://hl7.org/fhir/tag/security"; label="Break The Glass"

## Healthcare Privacy and Security Classification System (HCS)

The security labels described above are a subset of the full set of security labels defined by the HL7 Healthcare Privacy and Security Classification System (HCS; ref todo). The HCS defines 5 categories of security labels that may be applied to a resource:

|  |  |  |  |
| --- | --- | --- | --- |
| **Security Label** | **Card.** | **Values** | **Description** |
| Confidentiality Classification | 0..1 | [Confidentiality](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\Confidentiality\index.html) | Security label metadata classifying an IT resource (clinical fact, data, information object, service, or system capability) according to its level of sensitivity, which is based on an analysis of applicable privacy policies and the risk of financial, reputational, or other harm to an individual or entity that could result if made available or disclosed to unauthorized individuals, entities, or processes.  Example Uses: Unrestricted, Normal, Very restricted |
| Sensitivity Category | 0..\* | [InformationSensitivityPolicy](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\InformationSensitivityPolicy\index.html) | Security label metadata that "segments" an IT resource by categorizing the value, importance, and vulnerability of an IT resource perceived as undesirable to share.  Example Uses: STDs, Psychiatric care, Celebrity status |
| Compartment Category | 0..\* | [Compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\Compartment\index.html) | Security label metadata that "segments" an IT resource by indicating that access and use is restricted to members of a defined community or project  Note: this is a different use of "Compartment" to the [Patient Compartment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment) use.  Example Uses: Research, HR records |
| Integrity Category | 0..\* | [SecurityIntegrityObservationValue](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\SecurityIntegrityObservationValue\index.html) | Security label metadata that "segments" an IT resource by conveying the completeness, veracity, reliability, trustworthiness, and provenance of an IT resource  Example Uses: Anonymized, signed, patient reported |
| Handling Caveat | 0..\* | [SecurityControlObservationValue](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\SecurityControlObservationValue\index.html) | Security label metadata conveying dissemination controls and information handling instructions such as obligations and retention policies to which an IT resource custodian or receiver must comply. This type of handling caveat SHALL be assigned to a clinical fact if required by jurisdictional or organizational policy, which may be triggered by a patient consent directive  Example Uses: do not disclose, various restrictions on use, and policy marks |

Each of these security labels identifies a [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) that lists a set of possible codes for the security label.

### Jurisdiction Specific Security Labels

The HL7 Healthcare Classification System also allows for Realm-specific privacy law or policy category codes for use in security labels in particular domains. These domains are included with this specification:

|  |  |  |  |
| --- | --- | --- | --- |
| **Security Label** | **Card.** | **Values** | **Description** |
| US Privacy Law | 0..\* | [ActUSPrivacyLaw](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\ActUSPrivacyLaw\index.html) | Security label metadata that â€œsegmentsâ€ an IT resource by indicating the legal provisions to which the assignment of a Confidentiality Classification complies in the US |

# security.html

# FHIR Security

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Fast Healthcare Interoperability Resources (FHIR) is not a security protocol, nor does it define any security related functionality. However FHIR does define exchange protocols and content models that need to be used with various security protocols defined elsewhere. This section gathers all information about security in one section. A summary:

* Communications Security - all exchange of production data should be secured using TLS/SSL (e.g. https)
* Authentication - Users/Clients may be authenticated in any way desired. For web-centric use, OAuth is recommended
* Authorization/Access Control - FHIR defines a Security Label infrastructure to support access control management. FHIR may also define a set of resources to administer access control management, but does not define any at present
* Audit - FHIR defines [provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) and [audit event](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resources suitable for tracking the origins, authorship, history, status and access of resources
* Digital Signatures - FHIR includes several specifically reserved locations for digital signatures
* Attachments - FHIR allows for binary resources and attachments. These have their own concerns
* [Labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) - FHIR allows for set of security related tags that affect that way resources are handled
* Data Management Policies - FHIR defines a set of capabilities to support data exchange. Not all the capabilities that FHIR enables may be appropriate or legal for use in some combinations of context and jurisdiction (e.g. HIPAA for exchange between institutions). It is the responsibility of implementers to ensure that relevant regulations and other requirements are met
* Narrative - Care must be taken when displaying the narrative from FHIR resources

Time critical concerns regarding security flaws in the FHIR specification should be addressed to the [FHIR email list](http://wiki.hl7.org/index.php?title=FHIR_email_list_subscription_instructions) for prompt consideration.

Implementers should track the developing IHE IUA Profile for additional security considerations.

A production FHIR system will need some kind of security sub-system that administers users, user authentication and user-authorization. Where this sub-system fits into the deployment architecture is a matter for system design:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | |  |  | | --- | --- | |  | The consumer that is using a healthcare related system | |  | The client application the user is using (application, mobile app, website, etc.) | |  | The security system (authentication and access control) | |  | The clinical/healthcare repository | |

In this diagram, the red lines represent FHIR interfaces. From the perspective of the FHIR API, the client (consumer of FHIR services) may either interact with a security system that manifests as a FHIR server, and which depends on a subsequent FHIR interface to provide the actual storage, or either the client or server interacts with the security system independently. In each of these 3 scenarios, the different components may be assembled into applications or network components differently, but the same logical layout applies. The FHIR specification assumes that a security system exists, and that it may be deployed in front of or behind the FHIR API.

The security system includes the following subsystems:

* Authentication: Identifies and Authenticates the user
* Access Control decision engine: decides whether FHIR operations are allowed
* Audit Log: records actions to allow for subsequent review and detection of intrusion or inappropriate usage

Because there are a plethora of standards relating to the administration and functionality of the security system, FHIR does not provide user, profile, or other such administration resources. Instead, the FHIR resources are the targets of the policies expressed in these other approaches. What FHIR does specify is a way to apply [security labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) to resources so that a security system may use these (along with the contents of the resources if appropriate) to determine whether a user is authorized to perform a particular FHIR operation or not.

## Communications

For the [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), normal HTTP security rules apply. The [Service Root URL](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#root) will specify whether SSL is required. Client authentication may be required by the server, possibly including the requirement for client certificates.

TLS/SSL SHOULD be used for all production data exchange. The TLS/SSL communications are established prior to any HTTP command/response; so the whole FHIR interaction is protected by the SSL/TLS communications. The security of the endpoints of the TLS/SSL communications must be risk-managed, so as to prevent inappropriate risks (e.g. audit logging of the GET parameters into an unprotected audit log).

To support browser-based client applications, recommend that servers SHOULD implement [cross-origin resource sharing](http://enable-cors.org/) for the [REST operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html).

The choice of whether to return 403 or 404 depends upon the specific situation and specific local policies, regulations, and laws. The decision of which error to use will include consideration of whether disclosure of the existence of relevant records is considered an acceptable disclosure of PI or a prohibited disclosure of PI. Note that since a 404 does not leak information, it should be the default choice unless there is a specific reason to return a 403.

Chained search implementations need to observe the restrictions on a user in the chained search, and that it would be normal to simply omit resources from the search if the user is not authorized, but a server may elect to add an OperationOutcome to indicate that additional resources may be available if other access tokens are used (e.g. break the glass) ([example](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome-example-break-the-glass.html)).

## Authentication

Other than testing systems, FHIR servers should authenticate the clients. The server may choose to authenticate the client system and trust it, or to authenticate the individual user by a variety of techniques. For web-centric use, [OAuth](http://oauth.net/) may be used to authenticate and/or authorize the users. The [Smart-On-FHIR](http://docs.smarthealthit.org/) profile on OAuth is tightly integrated with FHIR, and is the preferred method for using OAuth.

## Authorization/Access Control

Correctly identifying people, devices, locations and organizations is one of the foundations that any security system is built on. Most applications of security protocols, whether authentication, access control, digital signatures, etc. rely on the correct mapping between the relevant resources and the underlying systems. Note that this isn't necessary: there is nothing in FHIR that requires or relies on any security being in place, or any particular implementation. But real world usage will generally require this.

A holder of data should not allow the data to be communicated unless there are sufficient assurances that the other party is authorized to receive it. This is true for a Client creating a resource through a PUT/POST, as much as it is true for a Server returning resources on a GET. The presumption is that without proper authorization, to the satisfaction of the data holder, the data does not get communicated.

The rules behind the Access Control decision are often very complex, and potentially depends on information sourced from:

* Client, such as User Identity, User Role, Location, level of assurance
* Resource, such as confidentiality, sensitivity, type of data, date ranges covered by the data, author of the data
* Patient, such as the patient identity, patient relationship to the user, patient consent policies
* Context of the transaction, system identity, time-of-day, purpose of use, workflow state, and transport security

For one source of further information, see the [IHE Access Control white paper](http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_WhitePaper_AccessControl_2009-09-28.pdf)

Access control constraints may result in data returned in a read or search being redacted or otherwise restricted. See [Variations between Submitted data and Retrieved data](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\updates.html).

## Audit Logging

FHIR provides a [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resource suitable for use by FHIR clients and servers to record when a security or privacy relevant event has occurred. This form of audit logging records as much detail as reasonable at the time the event happened.

The AuditEvent when used to record security and privacy relevant events can then be used by properly authorized applications to support audit reporting, alerting, filtering, and forwarding. This model has been developed and used in healthcare for a decade as [IHE-ATNA profile](http://wiki.ihe.net/index.php?title=Audit_Trail_and_Node_Authentication). ATNA log events can be automatically converted to AuditEvent resources, and from there, client applications are able to search the audit events, or subscribe to them.

With regard to HTTP logs, implementers need to consider the implications of distributing access to the logs. HTTP logs - even ones that only include the URL itself - should be regarded as sensitive as the resources themselves - even if direct PHI is kept out of the logs by careful avoidance of search parameters (e.g. by using GET), the logs will still contain a rich set of information about the clinical records.

## Digital Signatures

This specification recommends the use of [W3C Digital Signatures](http://www.w3.org/TR/xmldsig-core/) for signatures. Resources can be signed using the [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html) resource to carry a [detached digital signature](http://www.w3.org/TR/xmldsig-core/#def-SignatureDetached). The [Signature datatype](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#signature) is available to carry various Signature types including non-repudiation purposes. Further details on creation and valiation of [Signature is defined.](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#signature)

In addition, [documents may be signed](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html#signatures) using an [enveloped](http://www.w3.org/TR/xmldsig-core/#def-SignatureEnveloped) signature. A specification for Enveloped signature is profiled in the [IHE DSG profile](http://wiki.ihe.net/index.php?title=Document_Digital_Signature).

Neither of these definitions prohibits the use of other ways of using digital signatures.

**DSTU Note:** the use of signatures with RESTful interfaces is a poorly understood area, and we would welcome reports of implementation experience.

Feedback [here](http://wiki.hl7.org/index.php?title=FHIR_Specification_Feedback_(DSTU_2)).

## Attachments

Several FHIR resources include attachments. Attachments can either be references to content found elsewhere, or included inline encoded in base64. Attachments represent security risks in a way that FHIR resources do not, since some attachments contain executable code. Implementers should always use caution when handling resources.

## Security Labels

See [Security Labels](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html).

## Narrative

FHIR resources include an XHTML narrative, so that applications can display the contents of the resource to users without having to fully and correctly process the data in the resource. However displaying HTML is associated with several known security issues that have been observed in production systems in other contexts (e.g. [with CDA](http://smartplatforms.org/2014/04/security-vulnerabilities-in-ccda-display/)). For this reason, the [FHIR narrative is not allowed to contain active content](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html#security). However, care is still needed when displaying the narrative:

* Validate the narrative (the standard FHIR schemas do not allow active content, and the reference implementations won't handle it). Note, though, that external references could still be included in CSS, and these are outside the scope of schemas and reference implementations.
* Ensure that any external references to images or anchors (e.g. outside the resource) do not cause the display software to [leak sensitive information in headers](http://smartplatforms.org/2014/04/security-vulnerabilities-in-ccda-display/)
* Do not allow external links to run in a privileged context such as the EHR unless you are sure they can be trusted
* Care should be taken to differentiate HTTP RESTful (API) from browser based server content. Specifically one should separate user session cookies, as an attacker could create content that serves up with content-type "text/html" and has content like "<script>send\_to\_attacker(document.cookie);</script>".

Also note that the inclusion of an external reference to an image can allow the server that hosts the image to track when the resource is displayed. This may be a feature or a problem depending on the context.

In addition, to narrative [Documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) may also contain stylesheets. Unlike with CDA, the stylesheets are simple CSS stylesheets, not executable XSLT, so the same security risks do not apply. However CSS stylesheets may still reference external content (e.g. background images), and applications displaying documents should ensure that CSS links are not automatically followed without checking their safety first, and that session/identifying information does not leak with any use of external links.

# services.html

## Using Resources with Services

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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

**DSTU Note:** This page and [the other FHIR/SOA/Services page](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\soa.html) will be reconciled and collapsed to a single page during ballot reconciliation.

Though FHIR Resources are primarily designed with for the [RESTful HTTP-based implementation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), it is not necessary to use a RESTful interface when exchanging the resources; one way that they can be exchanged is in the context of services. Service Oriented Architecture (SOA) is an architecture pattern using services to encapsulate and provide discreet pieces of application functionality to each other. Services communicate by invoking public interfaces and exchanging information (as parameters and outputs) in accordance to a well-defined service contract.

FHIR resources or [bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle) may be used as the parameters or outputs of service interfaces.

Generally, the definition of particular services is a domain or context specific task, and it is anticipated that this would be done as separate specifications that make use of the underlying facilities defined in this specification. Services defined like this are able to build on the common underlying platform features defined in this specification such as REST or messaging, and add specific interactions where appropriate. Alternatively, the service interfaces can build an entirely separate implementation.

This specification defines a [Terminology Service](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminology-service.html) which is tightly integrated with the RESTful API. Definition of other additional services based on the service interface definitions provided by the [HL7 SOA work group](http://hssp.wikispaces.com/) will be considered if there is sufficient interest in this.

**DSTU Notice**: The RESTful interface is a profile on the existing [HL7/OMG HSSP RLUS specification](http://hssp-rlus.wikispaces.com/RLUS_FAQ) (see [comments on the RESTful specification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#hdata)). If there is interest, HL7 could define a SOAP equivalent to this. The main interest in this would be to provide a common technical base for other SOAP based services.

When implementing exchange of resources using a service-based approach, there are two aspects to keep in mind:

* Technical requirements when exchanging resources
* FHIR architectural issues to consider when using services

Both these impact on how services should manage exchanging resources in their design and implementation.

### Technical Requirements

A resource consists of an identifier, some metadata, narrative, and data. When the resources are used with a service, the context of use will need to describe how the id and meta data are managed.

A key question in this regard is whether the resources that are exchanged across a service interface need to also be handled in a RESTful context around the service. For example, a decision support provider service might receive a collection of resources on which a decision is required, and use an internal RESTful service to store and access them. In this case, it would need to take the resources out of the service context, and use them in a RESTful context, and generally the service would expect to see duplicate resources over time, where versions must be managed correctly. If the resources to be exchanged over services are also to be exchanged with REST, the metadata will be required to be managed carefully.

**Resource Identity**

All resources have a single identity (the full URL), and a logical id which may be maintained as the resource moves from server to server (see ["Managing Resource Identity"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html) for further discussion). Since this identity is used by any reference to the resource, it must be maintained when the resource is exchanged so that references from other resources to the one being exchanged can still be resolved. In other words, avoid exchanging the resource anonymously whenever possible.

Related to this, resources are modular units that refer to each other. Although resources stand-alone and are each processed independently, it's rarely possible to use a resource to achieve some clinical or business goal without retrieving other referenced resources. Any use of resources in a service environment needs to address how these references can be resolved. This can be achieved by delegating the reference resolution to a RESTful framework, by ensuring that all the relevant resources are contained in the service call, or by making some service based arrangement by which additional resources can be retrieved.

Services that exchange resources SHOULD maintain resource identity.

**Resource Version**

Resources have two metadata elements relating to versioning: "Resource.meta.versionId" and "Resource.meta.lastUpdated". Because of data/time resolution issues, systems implementing concurrency solutions are strongly recommended to depend on the versionId; the lastUpdated is provided to inform human users about information currency.

Services typically assume that the information in the service calls is the latest information. As a consequence, explicit version tracking is often not part of a service call. However if the resources in the service call then need to be used in a RESTful fashion, explicitly tracking the version and last modified date will make this subsequent usage much more efficient.

Services that exchange resources SHOULD include version information when the resources are exchanged.

**Capability Statement**

When using [RESTful exchange](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), [messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html), and [document based](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) exchange, the [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) allows authoring and reading applications to describe how they use a resource. The conformance statement supports trading partner negotiation from specification time through to run-time discovery. The conformance statement doesn't provide any equivalent way to make declarations about services, though this might be added in the future if common requirements emerge. Services are expected to make appropriate arrangements around discovery and compatibility, though it is expected that these will vary considerably.

Services that exchange resources MAY choose to provide support for describing and changing descriptions of service implementations.

### Architectural Considerations

FHIR Resources are designed to make use in a wide variety of contexts. In particular, FHIR resources are required to be suitable for use in a REST environment. This means that there are number of design requirements and choices that impact on how suitable resources are for use with services.

If service use was the only consideration, different decisions would be made, and resources would be more suitable for use with services. However this would curtail their usefulness and reusability in other contexts.

**Resource References**

The most obvious impact is that resources [refer to each other using full URL based references](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html), and there are a number of rules around how these references are resolved. In the context of a service, this means that the references between modules carry this extra weight of choice and obligation, even when it might not be necessary.

**Explicit State**

All resources represent the various states of the record and real world entities involved in a transaction explicitly. This is necessary for use in RESTful and document contexts, where there is no explicit transaction. Service interactions are typically associated with implicit semantics - a request to change the status of a particular resource to something else, for example. The fact that resources carry this state explicitly as well as the transaction fixing state implicitly creates duplication between the two, and this will need to be managed.

**Modularity**

The modularity of resources - which resources are defined, and why - is driven by a wide set of considerations around how they are used. Resources are a platform on which a set of business/clinical services of various kinds are provided. Accordingly, the resources are defined for general use, and they can be expected to be less suitable for a particular service than custom defined structures. The pay back is wider re-use of the information that the service deals with.

# signatures.html

# Digital Signatures

|  |  |  |
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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

todo - digital signatures in FHIR.

# snomedct.html

## Using SNOMED CT with FHIR

|  |  |  |
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| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | SNOMED CT is made managed by [IHTSDO](http://www.ihtsdo.org/). IHTSDO is an international standards organization with multiple different countries as members, each of which distribute their own variant of SNOMED CT |
| System | The URI <http://snomed.info/sct> identifies the SNOMED CT code system |
| Version | Where a version is used, it should be a full URI that represents the specific distribution, following the [SNOMED URI Specification](http://snomed.org/uristandard.pdf) (see note below) |
| Code | The following SNOMED CT artifacts are valid in the *code* element for the http://snomed.info/sct namespace: [Concept IDs](http://www.snomed.org/gl?t=glsct_st_ConceptId), [Expressions](http://www.snomed.org/gl?t=glsct_se_Expression) ([grammar](http://snomed.org/compgrammar.pdf)) and [SNOMED Legacy codes](http://www.snomed.org/tig?t=tsg2_metadata_refset_legacy).  Description Ids are not valid, nor are other concepts associated with SNOMED CT Concepts using the RF2 identifier infrastructure. Expressions SHOULD NOT contain terms, only concept IDs |
| Display | The correct display for a SNOMED CT concept is one of the preferred terms for the concept. Preferred terms are case sensitive. The Fully Specified Name is not an appropriate choice. The source of preferred name comes from a Language Reference Set. SNOMED CT does not define displays for expressions; if no display has been associated with the expression through a value set or other mechanism, the full expression syntax with preferred terms embedded may be used |
| Filter Properties | Several properties are defined as described below |

Note: The [IHTSDO glossary](http://snomed.org/gl.pdf) explains some of these SNOMED CT specific terms.

### Version Issues

There is no single distribution that contains all defined SNOMED CT codes in all contexts of use; instead, each national office distributes a set of version of a particular distribution. In addition, other release authorities may be designated. The [SNOMED URI Specification](http://snomed.org/uristandard.pdf) describes how to unambiguously reference a particular version of a distribution:

http://snomed.info/sct/[sctid]/version/[YYYYMMDD]

where [sctid] is the concept id of the SNOMED CT distribution (e.g. 32506021000036107 for Australia), and the tail is the date of release (by custom, this is usually the last day of the month). Note that many implementations are in the habit of simple using the date of release in the form YYYYMMDD (e.g. "20140531"), and assuming that the distribution is known. However this is not always safe, so implementations that populate the *version* element SHOULD use the full URI form.

### Copyright/License Issues

The use of SNOMED CT codes, display names and value sets in this specification is subject to *(basis to be confirmed)*. This does not convey the right to use SNOMED CT to any users of this specification; implementers must acquire a license to use SNOMED CT in their own right (from their national SNOMED CT authority, or elsewhere).

Note that the US distribution of SNOMED CT is currently used as the underlying system for the FHIR specification.

### SNOMED CT Filter Properties

This section documents the property filters that can be used with the SNOMED CT code system in value set composition statements.

For implementer convenience, some of the property filters are documented in terms of the [SNOMED CT Query Language](http://www.ihtsdo.org/fileadmin/user_upload/Docs_01/News/SNOMED_CT_Query_Specification_-__v0.08_-_20121213.doc), but this does not imply that its use is required. *To Do: what's the correct link for this>*

#### By Subsumption

|  |  |
| --- | --- |
| Description | Select a set of concepts based on subsumption testing |
| Property Name | concept |
| Operations Allowed | is-a |
| Values Allowed | [concept id] |
| Comments | Includes all concept ids that have a transitive is-a relationship with the concept Id provided as the value |
| Example | [Administation Methods](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-administration-method-codes.html) |
| SCT QL | DescendentsAndSelf([concept]) |

#### By Reference Set

|  |  |
| --- | --- |
| Description | Select a set of concepts based on their membership of a SNOMED CT reference set |
| Property Name | concept |
| Operations Allowed | in |
| Values Allowed | [concept id] |
| Comments | Includes all concept ids that are active members of the reference set identified by the concept Id provided as the value |
| SCT QL | MembersOf([concept]) |

#### By Snomed Query Expression

|  |  |
| --- | --- |
| Description | Select a set of concepts based on a formal expression statement |
| Property Name | expression |
| Operations Allowed | = |
| Values Allowed | [expression] |
| Comments | The result of the filter is the result of executing the given SNOMED CT expression. note: the query statement is under current development |

#### By whether post-coordination is allowed

|  |  |
| --- | --- |
| Description | Specify whether post-coordinations is allowed or not |
| Property Name | expressions |
| Operations Allowed | = |
| Values Allowed | true or false |
| Comments | Expressions, if allowed, are subject to the same rules as pre-coordinated concepts. Note: reference sets do not include expressions. |
| Example | [Administation Methods](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-administration-method-codes.html) |
| SCT QL | n/a |

### Implicit Value Sets

Implicit value sets are those whose specification can be predicted based on the grammar of the underlying code system, and the known structure of the URL that identifies them. SNOMED CT has two sets of implicit value sets: By Subsumption, and By Reference Set.

If any value set resources exist with an identifier that conforms to the URL patterns specified below, the content of the resource must conform to the template provided. Profiles and other value set references are allowed to reference these value sets directly (by reference as a URI, rather than by a value set reference, which is a literal reference).

A SNOMED CT implicit value set URL has two parts:

* the base URL is either "http://snomed.info/sct", or the URI for the edition version, in the format specified by the IHTSDO the [SNOMED URI Specification](http://snomed.org/uristandard.pdf)
* a query portion that specifies the scope of the content

"http://snomed.info/sct" should be understood to mean an unspecified edition/version. This defines an incomplete value set whose actual membership will depend on the particular edition used when it is expanded.

For the second part of the URL (the query part), the 3 possible values are:

* ?fhir\_vs - all Concept IDs in the edition/version. If the base URI is http://snomed.info/sct, this means all possible SNOMED CT concepts
* ?fhir\_vs=isa/[sctid] - all concept IDs that are subsumed by the specified Concept.
* ?fhir\_vs=refset/[sctid] - all concept IDs in the specified reference set

A value set with an identifier that follows the pattern "[edition/version]?fhir\_vs=isa/[sctid]" in the identifier follows this template:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

[Some HTML that describes this value set as all concepts subsumed by conceptid]

</div>

</text>

<identifier value="[edition/version]?fhir\_vs=isa/[sctid]"/>

<version value="[edition/version]"/>

<name value="SNOMED CT Concept [conceptid] and descendents"/>

<description value="All SNOMED CT concepts for [concept id or preferred description]"/>

<copyright value="This value set includes content from SNOMED CT, which is copyright Â© 2002+ International Health Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7. Implementer use of SNOMED CT is not covered by this agreement"/>

<status value="active"/>

<compose>

<include>

<system value="http://snomed.info/sct"/>

<filter>

<property value="concept"/>

<op value="is-a"/>

<value value="[sctid]"/>

</filter>

</include>

</compose>

</ValueSet>

A value set with an identifier that follows the pattern "[edition/version]?fhir\_vs=refset/[sctid]" in the identifier follows this template:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

[Some HTML that describes this value set as all concepts in the reference set identified by conceptid]

</div>

</text>

<identifier value="[edition/version]?fhir\_vs=refset/[sctid]"/>

<version value="[edition/version]"/>

<name value="SNOMED CT Reference Set [conceptid]"/>

<description value="All SNOMED CT concepts in the reference set [concept id or preferred description]"/>

<copyright value="This value set includes content from SNOMED CT, which is copyright Â© 2002+ International Health Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7. Implementer use of SNOMED CT is not covered by this agreement"/>

<status value="active"/>

<compose>

<include>

<system value="http://snomed.info/sct"/>

<filter>

<property value="concept"/>

<op value="in"/>

<value value="[conceptid]"/>

</filter>

</include>

</compose>

</ValueSet>

# soa.html

## Introduction: Services, Service-orientation (SOA) and FHIR

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| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

**DSTU Note:** This page and [the other FHIR/SOA/Services page](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html) will be reconciled and collapsed to a single page during ballot reconciliation.

This section clarifies what it means to apply SOA principles and specifications within a FHIR environment/implementation, and the converse. The use of SOA is an established discipline and provides a means of encapsulating behavior. Because the FHIR specification is still at an early stage of development, similar work within FHIR is presently less well developed.

The potential benefit of SOA to FHIR is leverage of previous work done in SOA environments thus allowing FHIR to leapfrog within SOA capabilities so that those developing FHIR implementations will not have to re-invent these wheels.

One of FHIR's greatest successes lies in its simplification of implementation. It does not currently contain out-of-the-box behavior for workflow, behaviors, etc., or well defined APIs. The common set of patterns that the SOA specifications provide can be leveraged to make implementation of complex behavior both more easily and more consistently than would be achieved without its use.

FHIR offers a highly flexible framework for interoperability that can be deployed and used in a varity of different ways. This flexibility can become a liability because systems designed for different patterns of use cannot easily interoperate. SOA principles can be used to provide an overall framework that leads to deployment and consistency. SOA provides guidance for how components interact, how to partition responsibilities, and how to manage workflows among different parts of systems, all of which have potential utility in FHIR implementation settings.

Note: FHIR is still under development, and this section is still under development too.

### Applying Business Context - Joining-up SOA and FHIR

*If I am doing FHIR, why do I care about SOA? Isn't SOA just a technology, and isn't REST either more current or just what Web Services uses anyway? Isn't REST better than SOAP?* These are very common questions that surface time and time again among implementers. FHIR is not a natural replacement for Service-oriented Architecture (SOA). Nor is SOA “better than” or “worse than” FHIR. If we consider both of these as approaches, there are natural complements which result in benefits from applying SOA techniques to FHIR.

One of FHIRs tremendous strengths lies in its accessibility, ease of implementation, and flexibility to be applied in a number of different situations without encumbering implementations with excessive burden. For any one implementation, these strengths stand on their own, but when multiple implementations need to work together, the likelihood of having multiple different (and incompatible) FHIR-based solutions to the same problem increases, resulting in inconsistency and interoperability challenges.

This section assesses different contexts to allow implementers to make informed decisions about the degree of impact of applying SOA techniques and to assess potential benefit for specific situations. It will identify the situational factors to consider, and the elements of the SOA discipline that can be applied for more effective FHIR implementation, providing a roadmap on how to optimize your implementation toolkit to make *you and your team* most effective.

## Relating SOA and FHIR

There are a few fundamental aspects of systems distribution that illustrate the principal differences between SOA and FHIR. At its core, FHIR is based upon the elemental capabilities of Create, Read, Update, Delete (CRUD), allowing access to *resources* where interaction is primarily based upon these operations. Of note, multi-step or complex processing levies requirements upon the calling, client application.

The objective of this ballot section is to identify areas of relative strength and weakness for both FHIR and SOA, and to identify where there are implementation benefits in applying techniques spanning the two approaches. This analysis was conducted from two perspectives:

***SOA in a FHIR Environment*** considers the benefits of applying SOA patterns and best-practices to a FHIR implementation community. In these cases, developers are faced with implementation decisions that have the potential to benefit from existing case studies, design patterns, or guidance that may either help provide consistency among FHIR implementations, or which may address gaps - either known or unidentified - resulting from implicit assumptions around a FHIR implementation.

***FHIR in a SOA Environment*** considers the implications of using FHIR in a large, established enterprise that has or is making investments in SOA infrastructure. In these cases, shared services, enterprise policies, and existing infrastructure is common, and FHIR implementations would need to fit within the fabric of that environment.

It merits mention that not every FHIR implementation benefits from SOA, and vice-versa. The goal of this section is to help implementers navigate based upon their specific considerations to help determine if and to what extent these approaches provide benefits.

### Comparing and Contrasting FHIR and SOA: Background Context

In order to best determine the overlaps, synergies, and alignment points between FHIR and SOA, the following comparative analysis has been conducted. The table identifies a number of qualities associated with distributed systems integration, and subsequently provides a qualitative scoring as to the “fitness” of three different implementation approaches to support that quality. The scoring is deliberately subjective as the intention is to help readers navigate to those alternatives best suited to a given situation. The implementation approaches are broad categories most exemplary of FHIR implementations, specifically:

*FHIR + REST*, also referred to as RESTful FHIR, which is the predominant approach for implementing FHIR today.

*FHIR + WS\** represents FHIR implementations using the web services stack as the communication protocol instead of REST. This would include use of FHIR resources as payload parameters in SOAP calls, for example.

*FHIR + SOA Pattern* illustrates the impact of applying interaction patterns, exception handing and role definition, guided by SOA practices, atop an implementation technology (SOAP, REST, or others).

**Contrast of Implementation Approaches**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Solution Quality** | **Short Description** | **#1:FHIR + REST** (RESTful FHIR) | **#2 FHIR + WS\*** | **#3 FHIR + SOA Pattern** | **Comments** |
| Support of transactional integrity | Transactions may involve multiple steps composed together into a single unit | ◒ | ◒ | ● | Transactional integrity is not assured in #1 or #2 but can be hand-coded. #3 assures that this is addressed |
| Support of stateless transactions | Transactions are independent and do not require supporting context | ● | ● | ● | Each of the implementation approaches are capable of supporting stateless processing |
| Support of "loose coupling" | Minimum of dependencies between the calling and responding system; reduces burden on client to from managing context of interaction with service | ◒ | ◒ | ● | The notion of "loose coupling" is fundamental to SOA and inherent in that architecture. Loose coupling can be supported by FHIR, but it does not innately do so |
| Use of FHIR Resources as Data Payload | Representation of FHIR resources for use as query or return parameters | ● | ● | ● | Data payload includes input data as well as data returned |
| Support of Dynamic Service Discovery | Provides for service registration, search, discovery, and late binding | ◒ | ◒ | ● | This is part of SOA specification and customary in implementations. For the others it is up to the approach |
| Provides resource-oriented operations | Supports ability to create, read, update, delete resources; | ● | ◒ | ◒ | Direct access to resources/data revisions in a strength of REST and FHIR. Direct access to fine-grained transactional operations are generally not supported within SOA |
| Suitability for atomic transactions | Fitness to support fine-grained transactions, such as data access or targeted update | ● | ◒ | ◒ | REST is ideally suited for point access or updates of specific data elements/resources - functions discouraged within SOA and WS\* |
| Suitability for composite transactions | Fitness to support complex transactions: context-sensitivity, multi-step workflows, etc. | ◒ | ● | ● | SOA provides for complex event processing, multi-step sequencing, orchestration |

*Sequencing* of events, particularly when those events involve orchestration of complex or dynamic processes, can benefit from the application of SOA techniques and patterns. This is common where multi-step processing is involved, and particularly important when adjustments to a process flow can be made based upon situational context. SOA design patterns are frequently used to govern interactions for dynamic processes, non-sequential workflows, or dynamic workflows involving human intervention and/or consideration of external factors as part of processing. The ability to model interaction patterns using languages such as SOAml, and to define roles and role interactions, are tools that may be useful to FHIR development in these circumstances, and would be indicators signaling that SOA has the potential to add value to a FHIR implementation.

SOA design principles can provide guidance to a FHIR implementer resulting in reduction of co-dependencies between components, promoting "loose coupling" and minimizing potential impacts resulting from changes to inner workings of one component adversely affecting others. (For those familiar with the term, this encourages "black box" implementation).

SOA provides guidance around data persistence, durability, and expectations in support of the data lifecycle.

These considerations are summarized in this table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Capability** | **#1:FHIR + REST** (RESTful FHIR) | **#2 FHIR + WS\*** | **#3 FHIR + SOA Pattern** | **Comments** |
| Supports dynamic adjustment in workflows | ○ | ◒ | ● | In a native FHIR environment, this must be done by hand. The WS\* stack provides for some interaction patterns, but limited. Use of formal notation (BPMN) and service orchestration is most robust option |
| Supports ability to batch multiple operations | ◒ | ◒ | ● | FHIR Batch allows for concatenation of multiple process steps. SOA Orchestration allows for fine grained control, grouping and sequencing of multiple operations |
| Provides for management of data coherence (e.g., Deadlocks, transactions) | ○ | ○ | ● | SOA principles define data governance, assigning responsibility for all data management within a service contract |
| Provide support for orchestration languages ([BPMN](http://www.bpmn.org/), [SOAml](http://www.omg.org/spec/SoaML/)) | ○ | ◒ | ● | SOA applys a systematic framework for orchestration using industry accepted formalisms, avoiding costs and complexities associated with an ad-hoc approach |

### Orchestration

*Orchestration* is a term typically used within SOA to describe the steps, sequencing, and dynamic adjustment of workflow to meet a process need. Orchestrations may be entirely automated and fulfilled in a short timeline, or longer and multistep in fulfillment of a business process that may involve manual steps and human intervention. In the context of FHIR implementation, orchestration would refer to the sequencing of collections of FHIR (or service) calls that are used in tandem to fulfil a specific need.

Orchestration is neither natively supported nor unsupported in FHIR, save the availability of the FHIR Batch mode which allows for some degree of compounding of operations. In a SOA environment, orchestration is typically realized by documenting in some formalism, such as Business Process Modeling Notation (BPMN), a sequence of steps and flows, and inherent logic or decision-points affecting that flow. An engine is then capable of executing the process flow, receiving inputs during execution to adjust or adapt those processes based upon situational need as part of delivery fulfillment.

There are many examples where this approach is advantageous. For example, in a Care Management situation, test results, current problems, chief complaint, and potentially even resource availability might affect subsequent steps in fulfilling a care plan. Based upon changes to any of these factors, the sequence of calls and ultimately the systems or FHIR servers involved would vary. The role of automated clinical decision support is another example that naturally ties to workflow orchestration, adjusting care pathways based upon patient evaluation and affecting process flows within a health system.

At present, to support this complexity within a FHIR setting without the use of SOA tools, these flows would need to be manually coded, either by having a directed sequence of calls, or by creating an independent capability effectively acting as an orchestrator. This can be supported within FHIR exclusively, but all of the steps and corresponding state management would need to be done by hand. FHIR Batch provides some of this capability, allowing for aggregation of multiple steps, but does not necessarily support the event processing needed in complex workflow situations.

## Approach Alternatives

Recognizing that there are situations where the coming-together of FHIR implementation and SOA techniques are advantageous, there are several implementation approaches available. Note that the selection of which approach is advantageous for any given situation will depend upon a variety of factors: existing legacy implementation and available APIs (particularly for interfacing applications), the strategic direction/IT roadmap of the organization, and so on.

* "Full Support in FHIR" Approach. This alternative involves simplification of the exposed behaviors of the service/server so as to be supported within the REST protocol, thus allowing full support within FHIR. Behind a FHIR technology stack, SOA design principles such as loose coupling and "black box" API design would be coded to create service autonomy.
* "Classic SOA with FHIR Payload" Approach. This alternative is attractive particularly in enterprises that have or are making investments in SOA infrastructure. This alternative relies upon traditional SOA service definition, leveraging use of FHIR Resources as the parameters into and out of the service.

It is important to note that electing to apply SOA patterns to FHIR implementation does not fundamentally change the nature of what is being implemented. ***Applied correctly, it results in minor adaptation to coding and interface design resulting in enhanced consistency across implementations as well as enhanced interoperability and robustness.***

### Implementation Considerations

Should the above evaluation factors result in a determination that FHIR/SOA guidance is useful, this section will describe specific implementation considerations to take into account. Please note that it is particularly important to determine which high-level categorization best fits your situation. For each high-level alternative, we present several implementation factors affected by the use of FHIR combined with SOA in that context. These "dimensions" apply to any implementation, and are described in the context of each category to illustrate their implications and differentiate among the approach alternatives.

We anticipate that future guidance will mature this thinking, providing code examples and prescriptive techniques more akin to an implementation guide.

#### SOA in a FHIR Environment

*("A FHIR Environment into which we are applying SOA Techniques")*

**Data Storage and Coherence.** Within a FHIR environment, storage is managed within the FHIR server, consistent with non-SOA FHIR implementations. Data consistency is the responsibility of the Server, but responsibility may carry to consuming applications if they are provided with sufficient update rights so as to make that a concern. Data validation also has a shared responsibility, first with the FHIR Server, and additionally with the authorized updating applications. Data visibility is a product of the REST interface, typically allowing CRUD operations down to the data element level.

**Transactional Integrity.** Updating applications maintain responsibility to sustain transactional integrity as state management is typically not performed within the FHIR server. The FHIR specification does not specifically provide for "rollback" in the event of transaction errors, as may be associated with complex or large transactions involving changes to multiple resources. If desired, coding will need to be done to accommodate this capability.

**API/Interface Design.**The default interface into a FHIR server is REST-based, providing CRUD operations and allowing for stateless access. The FHIR specification does not inherently provide for concurrency management (e.g., managing of "deadlock" conditions where two resources each await update permission from the other). As a result, within the FHIR server itself it is assumed that fault tolerance and server availability is being managed (beyond the scope of the specification).

SOA techniques may be useful in API design in the form of providing "design patterns" to govern interactions between FHIR servers and/or between client-to-server communications (such as the "Fire and Forget" pattern). These patterns can help foster loose coupling within FHIR, reducing the burden associated with intra-Server implementation and reducing risks associated with distributed processing. SOA can define encapsulation techniques to guide which and how FHIR functions are to be exposed. The HL7 SOA Workgroup has a portfolio of Service standards that may be useful in this regard.

The portfolio of HL7 Service Functional Models currently includes:

* IXS (Identification and Cross-Reference Services) that identifies the characteristic of a generic identification management services
* RLUS (Retrieve, Locate, Update Service) that supports the generic management resource in a SOA environment.
* ServD (Service directory) that supports the registration and discovery of health and human-related services
* CDSS (Clinical Decision Support Service) that defines a standard access interface to a clinical decision support system
* CTS2 (Common Terminology Service V 2) that defines the capabilities, responsibilities, inputs, outputs, and expected behavior to support the management, maintenance, and interaction with ontologies and medical vocabulary systems
* CCS (Care Coordination Service) that provides the capabilities to support the coordination of patient care across the care continuum spanning multiple organization [emerging specification]
* OS (Order Service) that provides functional capabilities for ordering pharmacy, laboratory, radiology, consult and nutritional services individually or part of an order set [emerging specification].
* EPSS (Event Publication & Subscription Service) that provides a Service Functional Model (SFM) for services, components and systems to subscribe to clinical events of interest and receive notice when new data are available [emerging specification].
* UCES (Unified Communications & Escalation Service) xxxxxx [emerging specification].

**Error Handling.**The FHIR specification does not specifically address error handling between and across servers and clients. When implementing within larger or more complex environments, particularly in situations where multiple FHIR servers may be involved (especially if they are provided by different vendors/implementations), error handing and management can quickly become complex and untenable.

SOA provides an implementation approach providing consistency in error handling, escalation, and error management. These tools can be leveraged to identify likely error conditions and exceptions based upon prior SOA work, helping to put into place infrastructure within FHIR to manage those exceptions. Moreover, this alignment creates future opportunity to more effectively integrate FHIR resources into an enterprise SOA fabric should that become a need.

**Security.**Identity management, access control, or other dimensions of a secure solution are inherently part of a service architecture. SOA guidance can foster an effective design involving FHIR in support of authentication, policy enforcement, role-based access controls, and a host of other provisions and protections. It is important to note that within SOA, security is an established, mainstream, and mature offering. Reuse of these concepts can help prevent inadequate, incomplete, or ineffective security measures within FHIR, and eliminate the need to re-invent solutions exclusively for FHIR.

#### "FHIR in a SOA Environment"

*("Applying FHIR to* ***Enterprise*** *Solutions")*

**Data Storage and Coherence.**In an enterprise environment, data storage and data management are typically governed by organizational policy. As such, that policy determines the operational parameters to be satisfied by the implementation. FHIR servers and their data persistence would need to fit within that policy, with data access channels into those data stores being in compliance with that policy.

Use of SOA-friendly interface protocols, such as SOAP and potentially REST, create the access channel for integration. Depending upon the degree of specificity of the interface, exceptions may need to be made to allow for use of FHIR Resources as part of parameterized payloads into and out of these services. Established minimum sets of data may be required to comply with data coherence expectations (in other words, it is often required to send data in context, and not just selectively include specific data elements). The organizations SOA architecture may govern and enforce these policies. Services have responsibility to interact with organizational policy enforcement points to assure appropriate permissions are in place.

**Transactional Integrity.**In part as a function of the "black box" design approach described above, data integrity and transactional integrity are in part enforced within each service as a result of the nature of their exposed APIs. Data update and integrity becomes the responsibility of each service. FHIR interfaces may be exposed as part of these services, but would be subject to the integrity rules/constraints of each service.

**API/Interface Design.** Services' API design and explicit exposing of service capabilities is an essential and elemental feature of a SOA architecture. Services provide loosely-coupled access (e.g., external clients do not have visibility into the inner workings of a service). Each service exposes specific interface capabilities and clients must use those capabilities. SOA interfaces are typically aligned with business functionality and are coarse-grained (such as "Register Patient" or "Validate Identity", etc.). Note that there is not necessarily a "perfect match" between SOA operations and RESTful operations -- Finer grained FHIR interactions may be encapsulated in coarse-grained functions. The API definition is where loose-coupling manifests in an implementation. Exposing an API access to the inner workings of a service has onward implications that potentially limit an ability to undertake technology or design changes within the service. The goal is to minimize technical dependencies, allowing maximum freedom to evolve and enhance the way a service operates without affecting what capabilities it provides.

For FHIR implementations, we recommend review of the HL7 SOA balloted healthcare standards, as well as reviewing SOA design patterns. There are many public sources of these patterns available on the web.

**Error Handling.** Error handling within SOA is defined and should be directly leveraged for implementations involving FHIR. We would not anticipate the need to change error management for FHIR, except to address payload-specific errors that may arise.

**Security.**Security is inherently a dimension of any enterprise SOA architecture, meaning that the responsibility within a service implementation is to provide the "hooks" to interact with that architecture. In other words, the service does not need to create or enforce security, it needs to interact with those enterprise components that have that responsibility.

Enterprises typically have security architecture into which a SOA environment will have already integrated. Service implementations would rely upon this existing infrastructure as part of authentication, access control, etc. Policy enforcement is a function of the architecture and not a specific service itself. Services would rely upon policy enforcement points to govern access to information.

While technical dimensions of security would be addressed by the security architecture directly, FHIR implementers should anticipate that data-specific access control policies would need to be captured and formalized so that they are enforceable within the architecture. For example, if a new service is handling protected health information, the policy enforcement point within the architecture would need to know that the service has that nature of data.

### Conclusion

FHIR and SOA are not competing technologies; rather they are complementary implementation approaches that have the potential to augment each other dependent upon the context for their use. As implementation decisions are undertaken, we advise evaluation of the contextual landscape to determine the degree of SOA applicability to a FHIR project, or vice-versa.

FHIR has proven itself as beneficial in that it provides an easy-to-implement and coherent approach to accessing healthcare resources using a modern protocol stack. SOA has proven itself over time in multiple vertical market segments as a way to divide responsibilities and authoritatively manage information across distributed systems. Marrying the discipline of SOA with the implementation ease of FHIR is a winning combination when the situation warrants.

Note that this section is less about a technology protocol as it is about alignment and architectural fit, such as encapsulating behavior, data representation in service calls, and division of responsibilities between a service implementation and the service consumers and other supporting services. We envision maturing this section to include specific service examples, exemplary code, and potentially self-evaluation checksheets or maturity models to help guide implementers toward effective solutions. Feedback on this section is welcomed and may be directed to the SOA list at [soa@hl7.org](mailto:soa@hl7.org)

# summary.html

# Introducing HL7 FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIRÂ® â€“ Fast Healthcare Interoperability Resources (hl7.org/fhir) â€“ is a next generation standards framework created by HL7. FHIR combines the best features of HL7's Version 2, Version 3 and CDAÂ® product lines while leveraging the latest web standards and applying a tight focus on implementability.

FHIR solutions are built from a set of modular components called â€œResourcesâ€. These resources can easily be assembled into working systems that solve real world clinical and administrative problems at a fraction of the price of existing alternatives. FHIR is suitable for use in a wide variety of contexts â€“ mobile phone apps, cloud communications, EHR-based data sharing, server communication in large institutional healthcare providers, and much more.

## Why FHIR is better

FHIR offers many improvements over existing standards:

* A strong focus on implementation â€“ fast and easy to implement (multiple developers have had simple interfaces working in a single day)
* Multiple implementation libraries, many examples available to kick-start development
* Specification is free for use with no restrictions
* Interoperability out-of-the-boxâ€“ base resources can be used as is, but can also be adapted for local requirements
* Evolutionary development path from HL7 Version 2 and CDA â€“ standards can co-exist and leverage each other
* Strong foundation in Web standardsâ€“ XML, JSON, HTTP, OAuth, etc.
* Support for RESTful architectures and also seamless exchange of information using messages or documents
* Concise and easily understood specifications
* A Human-readable wire format for ease of use by developers
* Solid ontology-based analysis with a rigorous formal mapping for correctness

## Flexibility

A central challenge for healthcare standards is how to handle variability caused by diverse healthcare processes. Over time, more fields and optionality are added to the specification, gradually adding cost and complexity to the resulting implementations. The alternative is relying on custom extensions, but these create many implementation problems too.

FHIR solves this challenge by defining a simple framework for extending and adapting the existing resources. All systems, no matter how they are developed, can easily read these extensions and extension definitions can be retrieved using the same framework as retrieving other resources.

In addition, each resource carries a human-readable text representation using html as a fallback display option for clinical safety. This is particularly important for complex clinical information where many systems take a simple textual/document based approach.

## Example Resource: Patient

This simple example shows the important parts of a resource: a local extension, the human readable HTML presentation, and the standard defined data content.

FHIR has resources for administrative concepts such as patient, provider, organization and device as well as a wide variety of clinical concepts covering problems, medications, diagnostics, care plans, financial concerns and more.

## The FHIR development process

FHIR is published as a Draft Standard for Trial Use. During the Trial Use phase, HL7 actively monitors implementations in order to continue to improve the specification, and is able to be responsive to their needs. Due to the many advantages FHIR offers, trial use is already beginning right now.

<http://hl7.org/fhir>. Follow us on Twitter using [#FHIR](https://twitter.com/search?q=%23FHIR)

# template-abstract-book.html

# Resource Definition:

.

## Resource Content

Alternate definitions: [Schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xsd), RDF (to do), XMI (to do), [Resource Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.profile.xml)

# template-abstract-definitions.html

## Resource - Detailed Descriptions

Detailed Descriptions for the elements in the .

# template-abstract-examples.html

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.

# template-abstract.html

## Resource Content

* [Structure](#tabs-struc)
* [UML](#tabs-uml)
* [XML](#tabs-xml)
* [JSON](#tabs-json)
* [All](#tabs-all)

**Structure**

**UML Diagram**

**XML Template**

**JSON Template**

**Structure**

**UML Diagram**

**XML Template**

**JSON Template**

# template-book-defn.html

# Resource Detailed Descriptions:

The Detailed Descriptions for the resource.

# template-book-ex.html

# Examples:

Examples for the resource.

# template-book.html

# Resource - Content

|  |  |  |
| --- | --- | --- |
|  |  |  |

.

## Resource Content

See also the [Examples](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\Ex.html) and the [Definitions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\Defn.html).

Alternate definitions: [Schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xsd), RDF (to do), XMI (to do), [Resource Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.profile.xml)

# template-comparison-set.html

## Comparison

This is a comparison between the 2 implementation guides and , generated to help compare the interoperability of implementations based on the two implementation guides, or, alternatively, for implementers to understand what is required to conform to both implementation guides.

The comparison consists of a series of comparisons between the constraint definitions defined in the implementation guide. For each comparison, implementers can review:

* A series of messages from the comparison algorithm. Errors indicate that solutions cannot be interoperable across both implementation guides (or that there are structural flaws in the definition of at least one)
* The intersection of the 2 constraint statements. This is what resource authors (either client or server) would need to conform to produce content valid against both implementation guides
* The union of the 2 constraint statements. This is what resource authors (either client or server) would need to be able to handle to accept content valid against either implementation guides

### Comparisons

### ValueSets

# template-comparison.html

## vs

### Messages

A series of messages from the comparison algorithm. Errors indicate that solutions cannot be interoperable across both implementation guides (or that there are structural flaws in the definition of at least one).

### Intersection

The intersection of the 2 constraint statements. This is what resource authors (either client or server) would need to conform to produce content valid against both implementation guides.

### Union

The union of the 2 constraint statements. This is what resource authors (either client or server) would need to be able to handle to accept content valid against either implementation guides.

# template-compartment-book.html

# Compartment

|  |  |
| --- | --- |
| Description |  |
| Identity |  |
| Membership |  |

Resource based membership rules:

See [information about compartments](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment).

# template-compartment.html

# Compartment

|  |  |
| --- | --- |
| Formal URI |  |
| Description |  |
| Identity |  |
| Membership |  |

Resource based membership rules:

See [information about compartments](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#compartment).

# template-conformance-pack.html

### Content

# template-definitions.html

## Resource - Detailed Descriptions

Detailed Descriptions for the elements in the resource.

# template-dictionary.html

# template-example-json.html

Raw JSON (canonical form)

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.

# template-example-xml.html

Raw XML (canonical form)

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.

# template-example.html

This is the narrative for the resource. See also the [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html) format.

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.

# template-examples.html

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.

# template-explanations.html

## Resource - Design Notes

to do

# template-extension-definitions.html

## Extension - Detailed Descriptions

Detailed Descriptions for the elements in the extension.

# template-extension-mappings.html

Mappings for the extension.

# template-extension.html

# Extension:

URL for this extension:

Status: .

## Extension Content

* [Summary](#tabs-struc1)
* [Full Structure](#tabs-struc2)
* [XML](#tabs-xml)
* [JSON](#tabs-json)
* [All](#tabs-all)

**Summary**

**Fulle Structure**

**XML Template**

**JSON Template**

**Summary**

**Full Structure**

**XML Template**

**JSON Template**

# template-ig-operations.html

## Operations defined by

This Implementation guide defines :

For more information about operations, including how they are invoked, see [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html).

# template-ig-toc.html

## Table of Contents

# template-logical-definitions.html

## Resource - Detailed Descriptions

Detailed Descriptions for the elements in the resource.

# template-logical-mappings.html

Mappings for the resource.

# template-logical.html

# Logical Model - Content

## Logical Model Content

* [Structure](#tabs-struc)
* [UML](#tabs-uml)
* [Both](#tabs-all)

**Structure**

**UML Diagram**

**Structure**

**UML Diagram**

# template-mappings.html

Mappings for the resource.

# template-operations.html

## Resource - Operations

This resource has associated with it:

For more information about operations, including how they are invoked, see [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html).

# template-print.html

# Resource Definition:

.

## Resource Content

Alternate definitions: [Schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xsd), RDF (to do), XMI (to do), [Resource Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.profile.xml)

## Examples

|  |
| --- |
|  |

## Detailed Descriptions

The Detailed Descriptions for the elements above

# template-profile-constraint.html

# template-profile-definitions.html

#### - Detailed Descriptions

Definitions for the Profile.

# template-profile-example-json.html

# - JSON

# template-profile-example-xml.html

# - XML

# template-profile-examples.html

# Examples

# template-profile-mappings.html

#### - Mappings

Mappings for the Profile.

# template-profile-questionnaire.html

## - Example Form

This is an example form based on a questionnaire generated from the definition, to help visualise the content. See also the [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html) questionnaire.

# template-profile.html

The official URL for this profile is:

This profile was published on by .

#### Formal Views of Profile Content

[Description of Profiles, Differentials, Snapshots, and how the XML and JSON presentations work](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html).

* [Text Summary](#tabs-summ)
* [Differential Table](#tabs-diff)
* [Snapshot Table](#tabs-snap)
* [XML Template](#tabs-xml)
* [JSON Template](#tabs-json)
* [All](#tabs-all)

This structure is derived from .

This structure is derived from .

todo

This structure is derived from .

**Differential View**

This structure is derived from .

**Snapshot View**

**XML Template**

**JSON Template**

todo

Other representations of profile:

.

# template-profiles.html

## Resource - Profiles

|  |
| --- |
|  |

# template-questionnaire.html

## - Example Form

This is an example form based on a questionnaire generated from the definition, to help visualise the content. See also the [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html) questionnaire.

# template-search-parameter.html

Search Parameter (type: ) defined as part of [the Profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.html).

Other Details:

* Full URL :
* Paths :
* Targets :

# template-tx-book.html

# Codes defined in

Formal value Set definition (identifier ): [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html).

See [the full registry of codes](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-codes.html) defined as part of FHIR.

The OID for the value set is (OIDs are not used in FHIR, but may be used in v3, or OID based terminology systems).

Explanation of the columns that may appear on this page:

|  |  |
| --- | --- |
| Id | The internal identifier for the concept (when the value set defines its own codes) |
| Level | A few code lists that FHIR defines are hierarchical - each code is assigned a level. In this scheme, some codes are under other codes, and imply that the code they are under also applies |
| Source | The source of the definition of the code (when the value set draws in codes defined elsewhere) |
| Code | The code (used as the code in the resource instance) |
| Display | The display (used in the *display* element of a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding)). If there is no display, implementers should not simply display the code, but map the concept into their application |
| Definition | An explanation of the meaning of the concept |
| Comments | Additional notes about how to use the code |

# template-tx.html

# Value Set for codes in

This is a value set defined by the FHIR project

**Summary**

|  |  |
| --- | --- |
| Code System URL: |  |
| Value Set URL: |  |
| Definition: |  |

Formal value Set definition : [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html).

**OIDs**

|  |  |
| --- | --- |
| Code System OID: |  |
| Value Set OID: |  |
| Note: these OIDs are not used in FHIR, but may be used in v3, or OID based terminology systems | |

See [the full registry of value sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-valuesets.html) defined as part of FHIR.

Explanation of the columns that may appear on this page:

|  |  |
| --- | --- |
| Level | A few code lists that FHIR defines are hierarchical - each code is assigned a level. In this scheme, some codes are under other codes, and imply that the code they are under also applies |
| Source | The source of the definition of the code (when the value set draws in codes defined elsewhere) |
| Code | The code (used as the code in the resource instance) |
| Display | The display (used in the *display* element of a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding)). If there is no display, implementers should not simply display the code, but map the concept into their application |
| Definition | An explanation of the meaning of the concept |
| Comments | Additional notes about how to use the code |

In addition, this page will include mappings to HL7 v2 or HL7 v3 code where these have been defined.

# template-vs-book.html

# Value Set

This is a value set defined by the FHIR project

Detailed Descriptions: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html).

The OID for the value set is (OIDs are not used in FHIR, but may be used in v3, or OID based terminology systems).

See [the full registry of value sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-valuesets.html) defined as part of FHIR.

# template-vs-ig-book.html

# Value Set

Detailed Descriptions: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html).

# template-vs-ig.html

# Value Set

Detailed Descriptions: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html).

# template-vs.html

# Value Set

This is a value set defined

**Summary**

|  |  |
| --- | --- |
| Defining URL: |  |
| Name: |  |
| Definition: |  |
| OID: | (for OID based terminology systems) |
| Source Resource | [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xml.html) / [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.json.html) |

## Content Logical Definition

See [the full registry of value sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-valuesets.html) defined as part of FHIR.

Explanation of the columns that may appear on this page:

|  |  |
| --- | --- |
| Level | A few code lists that FHIR defines are hierarchical - each code is assigned a level. In this scheme, some codes are under other codes, and imply that the code they are under also applies |
| Source | The source of the definition of the code (when the value set draws in codes defined elsewhere) |
| Code | The code (used as the code in the resource instance) |
| Display | The display (used in the *display* element of a [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding)). If there is no display, implementers should not simply display the code, but map the concept into their application |
| Definition | An explanation of the meaning of the concept |
| Comments | Additional notes about how to use the code |

# template.html

# Resource - Content

|  |  |  |
| --- | --- | --- |
|  |  |  |

## Resource Content

* [Structure](" \l "tabs-struc)
* [UML](#tabs-uml)
* [XML](#tabs-xml)
* [JSON](#tabs-json)
* [All](#tabs-all)

**Structure**

**UML Diagram**

**XML Template**

**JSON Template**

**Structure**

**UML Diagram**

**XML Template**

**JSON Template**

Alternate definitions: [Schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.xsd)/[Schematron](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.sch), Resource Profile ([XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.profile.xml.html), [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\.profile.json.html)), [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\-questionnaire.html)

# terminologies-bindings.html

## Terminology Bindings

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This table contains a list of all the terminology bindings in FHIR.

# terminologies-conceptmaps.html

## Mappings between Value Sets Defined in FHIR

This table contains a list of all the mappings between value sets that are defined as part of the FHIR specification.

Implementation Guides that define concept maps:

# terminologies-systems.html

## Known Code Systems

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The following names (URIs) may be used in the *system* element of the [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) data type. If a URI is defined here, it SHALL be used in preference to any other identifying mechanisms. If a code system is not listed here, the correct URI may be determined by working through the following list, in order:

* the HL7 OID Registry
* the documentation associated with the code system
* consulting the owner of the code system
* asking on the HL7 vocabulary mailing list

See also the [list of known identifier systems](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\identifier-registry.html) that can be used in the *system* element of the [Identifier](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Identifier) data type. Additional identifier systems may be registered on the HL7 FHIR registry at <http://fhir.org/registry>.

**Important Notes:**

* This list of names is incomplete and subject to change. Some values may be dropped and others will likely be added in the coming months as HL7 institutes formal processes around URIs in vocabulary
* Note that some of the URNs in this list follow the URN specification in [RFC 5141](http://tools.ietf.org/html/rfc5141) for referring to standards published by ISO, such as urn:iso:std:iso:11073:10101. Where ISO standards define codes with meanings, and there is no entry in the list above, and they are not registered in the HL7 OID registry, the default URN for the code system is that defined by the RFC 5141.
* For several of the code systems in this list, multiple systems are given. This means that the variants identified are different code systems, not just variants of the the same code system

|  |  |  |  |
| --- | --- | --- | --- |
| **URI** | **Source** | **Comment** | **OID** |
| **Externally Published code systems** | | | |
| http://snomed.info/sct | SNOMED CT ([IHTSDO](http://ihtsdo.org)) | See [Using SNOMED CT with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html) | 2.16.840.1.113883.6.96 |
| http://www.nlm.nih.gov/research/umls/rxnorm | RxNorm ([US NLM](http://www.nlm.nih.gov/)) | See [Using RxNorm with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html) | 2.16.840.1.113883.6.88 |
| http://loinc.org | LOINC ([LOINC.org](http://loinc.org)) | See [Using LOINC with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html) | 2.16.840.1.113883.6.1 |
| http://unitsofmeasure.org | UCUM: ([UnitsOfMeasure.org](http://unitsofmeasure.org)) Case Sensitive Codes | See [Using UCUM with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ucum.html) | 2.16.840.1.113883.6.8 |
| http://ncimeta.nci.nih.gov | [NCI Metathesaurus](http://ncimeta.nci.nih.gov) | See [Using NCI Metathesaurus with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ncimeta.html) | 2.16.840.1.113883.3.26.1.2 |
| http://www.ama-assn.org/go/cpt | [AMA CPT codes](http://www.ama-assn.org/go/cpt) | See [Using CPT with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\cpt.html) | 2.16.840.1.113883.6.12 |
| http://hl7.org/fhir/ndfrt | [NDF-RT (National Drug File â€“ Reference Terminology)](http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NDFRT/) | See [Using NDF-RT with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ndfrt.html) | 2.16.840.1.113883.6.209 |
| http://fdasis.nlm.nih.gov | [Unique Ingredient Identifier (UNII)](http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm) | See [Using UNII with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\unii.html) | 2.16.840.1.113883.4.9 |
| http://hl7.org/fhir/sid/ndc | [NDC/NHRIC Codes](http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm) | See [Using NDC with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ndc.html) | 2.16.840.1.113883.6.69 |
| http://hl7.org/fhir/sid/cvx | [CVX (Vaccine Administered)](http://www2a.cdc.gov/vaccines/iis/iisstandards/vaccines.asp?rpt=cvx) | See [Using CVX with FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\cvx.html) | 2.16.840.1.113883.12.292 |
| urn:iso:std:iso:3166 | [ISO 2 letter Country Codes](http://www.iso.org/iso/country_codes.htm) | a few country codes have been reused (e.g. CS). If a version is needed, simply use the year of publication e.g. 1998 | 1.0.3166.1.2.2 |
| http://www.nubc.org/patient-discharge | [NUBC](http://www.nubc.org) code system for Patient Discharge Status | National Uniform Billing Committee, manual UB-04, UB form locator 17 | 2.16.840.1.113883.6.301.5 |
| http://www.radlex.org | [RadLex](http://www.radlex.org) |  | 2.16.840.1.113883.6.256 |
| http://hl7.org/fhir/sid/icd-10  http://hl7.org/fhir/sid/icd-10-de  http://hl7.org/fhir/sid/icd-10-nl  http://hl7.org/fhir/sid/icd-10-us | ICD-10 International ([WHO](http://www.who.int/classifications/icd/en/)) & Local Variants |  | 2.16.840.1.113883.6.3  1.2.276.0.76.5.409  2.16.840.1.113883.6.3.2  ?? |
| http://www.icd10data.com/icd10pcs | [ICD-10 PCS Codes](http://www.icd10data.com/icd10pcs) ([CMS](http://www.cms.gov/Medicare/Coding/ICD10/)) |  | 2.16.840.1.113883.6.4 |
| http://hl7.org/fhir/sid/icd-9-cm  http://hl7.org/fhir/sid/icd-9-cm/diagosis  http://hl7.org/fhir/sid/icd-9-cm/procedure | ICD-9 USA ([CDC](http://www.cdc.gov/nchs/icd/icd9.htm)) |  | 2.16.840.1.113883.6.42  ?  ? |
| http://hl7.org/fhir/sid/icpc-1  http://hl7.org/fhir/sid/icpc-1-nl  http://hl7.org/fhir/sid/icpc-2 | ICPC (International Classification of Primary Care) ([PH3C](http://www.ph3c.org/)) |  | 2.16.840.1.113883.2.4.4.31.1  2.16.840.1.113883.6.139 |
| http://hl7.org/fhir/sid/icf-nl | ICF (International Classification of Functioning, Disability and Health) ([WHO](http://www.who.int/classifications/icf/en/)) |  | 2.16.840.1.113883.6.254 |
| http://hl7.org/fhir/v2/[X](/v) | [Version 2 tables](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v2.html) | [X] is the 4 digit identifier for a table. e.g. http://hl7.org/fhir/v2/0203 Note: only [some tables](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v2.html) may be treated in this fashion. For some tables, the meaning of the code is version dependent, and so additional information must be included in the namespace, e.g. http://hl7.org/fhir/v2/0123/2.3+, as defined in the [v2 table namespace list](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v2.html). Version 2 codes are case sensitive. | 2.16.840.1.113883.12.[X] |
| http://hl7.org/fhir/v3/[X] | [A Version 3 code system](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v3.html) | [X] is the code system name. e.g. http://hl7.org/fhir/v3/GenderStatus. Version 3 code systems are case sensitive. | see [v3 list](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-v3.html) |
| http://www.whocc.no/atc | Anatomical Therapeutic Chemical Classification System ([WHO](http://www.whocc.no/atc/structure_and_principles/)) |  | 2.16.840.1.113883.6.73 |
| urn:ietf:bcp:47 | IETF language (see [Tags for Identifying Languages - BCP 47](http://tools.ietf.org/html/bcp47)) | This is used for identifying langauge throughout FHIR. Note that usually these codes are in a code and the system is assumed |  |
| urn:ietf:bcp:13 | Mime Types (see [Multipurpose Internet Mail Extensions (MIME) Part Four - BCP 13](http://tools.ietf.org/html/bcp13)) | This is used for identifying the mime type system throughout FHIR. Note that these codes are in a code (e.g. [Attachment.contentType](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Attachment) and in these elements the system is assumed). This system is defined for when constructing value sets of mime type codes |  |
| urn:iso:std:iso:11073:10101 | Medical Device Codes defined in ISO 11073-10101 (see [RTM Management service](http://hit-testing.nist.gov:13110/rtmms/index.html#rosetta)) | The ISO/IEEE 11073-10201 Terminology Code is used in the *code* element, and the Terminology Reference ID is used in the *display* element (CODE10 and REFID in the reference) | 2.16.840.1.113883.6.24 |
| [http://nema.org/dicom/dicm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-dicom-dcim.html) | DICOM Code Definitions | The meanings of codes defined in DICOM, either explicitly or by reference to another part of DICOM or an external reference document or standard | 1.2.840.10008.2.16.4 |
| **Code Systems for Genetics** | | | |
| http://www.genenames.org | HGNC: Human Gene Nomenclature Committee |  | 2.16.840.1.113883.6.281 |
| http://www.ensembl.org | ENSEMBL reference sequence identifiers | Maintained jointly by the European Bioinformatics Institute and Welcome Trust Sanger Institute | *not assigned yet* |
| http://www.ncbi.nlm.nih.gov/nuccore | REFSEQ : National Center for Biotechnology Information (NCBI) Reference Sequences |  | 2.16.840.1.113883.6.280 |
| http://www.ncbi.nlm.nih.gov/clinvar | ClinVar | NCBI central respository for curating pathogenicity of potentially clinically relevant variants | *not assigned yet* |
| http://sequenceontology.org | Sequence Ontology |  | *not assigned yet* |
| http://www.hgvs.org/mutnomen | HGVS : Human Genome Variation Society |  | 2.16.840.1.113883.6.282 |
| http://www.ncbi.nlm.nih.gov/projects/SNP | DBSNP : Single Nucleotide Polymorphism database |  | 2.16.840.1.113883.6.284 |
| http://cancer.sanger.ac.uk/ cancergenome/projects/cosmic | COSMIC : Catalogue Of Somatic Mutations In Cancer |  | 2.16.840.1.113883.3.912 |
| http://www.lrg-sequence.org | LRG : Locus Reference Genomic Sequences |  | 2.16.840.1.113883.6.283 |
| http://www.omim.org | OMIM : Online Mendelian Inheritance in Man |  | 2.16.840.1.113883.6.174 |
| http://www.ncbi.nlm.nih.gov/pubmed | PubMed |  | 2.16.840.1.113883.13.191 |
| http://www.pharmgkb.org | PHARMGKB : Pharmacogenomic Knowledge Base |  | 2.16.840.1.113883.3.913 |
| http://clinicaltrials.gov | ClinicalTrials.gov |  | 2.16.840.1.113883.3.1077 |
| **Code systems defined as part of FHIR** | | | |

# terminologies-valuesets.html

## Value Sets Defined in FHIR

This table contains a list of all the value sets defined as part of the FHIR specification. Some of these value sets include codes defined elsewhere, some contain their own inline code system definitions, and some do both. Any implicit code systems are case sensitive, though FHIR will never define codes that only differ by case.

Implementation Guides that define value sets:

# terminologies.html

# Using Codes in Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Many elements in the FHIR resources have a **coded value**: some fixed string (a sequence of characters) assigned elsewhere that identifies some defined "concept". The sequence of characters and its meaning may be defined in one of several places:

* As one of a set of fixed values defined in this specification
* In an internet RFC (e.g. mime type, language)
* An HL7 specification (v3 code system, or v2 table)
* Some external terminology or ontology such as [LOINC](http://loinc.org), or [SNOMED CT](http://www.ihtsdo.org)
* A locally maintained dictionary, look up table or enumeration in an application (for further discussion of locally defined value sets, see ["Profiling FHIR"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html)

All of these kinds of ways of defining codes are collectively called "code systems". This list is far from complete; there are many ways to define code systems, and they vary widely in sophistication and size.

Throughout this specification, coded values are always treated as a pair composed of "system" and "code", where the system is a URL that identifies the code system that defines the codes. Note that system values are always case sensitive. Different code systems make their own rules as to whether the codes they define are case sensitive or not. Note that all the codes defined by FHIR itself are case sensitive and SHALL be used in the provided case (usually, but not always, lowercase).

The FHIR framework for using coded values is based on the fundamental framework defined in section 5 of the [HL7 v3 Core Principles](http://www.hl7.org/documentcenter/public/standards/V3/core_principles/infrastructure/coreprinciples/v3modelcoreprinciples.html) document, including the separation between code systems and value sets.

When codes are carried in resources, one of 4 different data types is used:

|  |  |
| --- | --- |
| [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) | The instance represents the *code* only. The *system* is implicit - it is defined as part of the definition of the element, and not carried in the instance. |
| [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) | A data type that has a *code* and a *system* element that identifies where the definition of the code comes from |
| [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept) | A type that represents a concept by plain text and/or one or more *Codings* |
| [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity) | Special case: has *system* and *code* elements for carrying a code for the type of unit |

Note: generally the choice of data type is dictated by the resource itself. When choosing a data type for an [extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html), see the FHIR wiki for [advice about data type choice](http://wiki.hl7.org/index.php?title=FHIR_Guide_to_Designing_Resources#Choice_of_coding_data_type).

## Coded Values, Systems, and Value Sets

The set of coded values that is allowed to be used in an element of one of these 4 data types is known as a ["value set"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html). Anywhere these data types are used, the specification "binds" a value set to the element.

The difference between a code system and a value set is an important distinction that is easily missed by implementers, since the difference is often overlooked in system design. For instance, it's not unusual to see an application table that is a mixed list of codes, containing some LOINC codes and also some additional in-house codes. Quite often, there is no explicit differentiation between them; only the fact that a code happens to look like a LOINC code betrays its origin.

For data exchange, on the other hand, explicitly tracking the source of the code is both important and necessary. In order to do this, each code system that defines codes is assigned a URL that identifies it, and all the codes it defines are actually a pair ("Code Pair": a name with a namespace). So in the case of this mixed list example from the previous paragraph, there are two code systems: [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html) (http://loinc.org) and a local one (let's say it has been given the URL: http://example.com/codesystems/additional-test-codes). The application table is a single value set (a set of Code Pairs) that includes codes from each of those two namespaces. The value set itself is given its own URL as an identifier (e.g. "http://example.com/fhir/ValueSet/test-codes)") - this identifies the set of Code Pairs, but is never used as the namespace in a actual code pair, or in an instance. In FHIR, Code Pairs are always represented as "code" and "system", except for the simple [data type "code"](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) data type where the namespace (e.g. the system element/property) is fixed in the schema and not represented explicitly.

## Choosing a system

The URL in a system is always a reference to a code system, not to a value set. The system ensures that codes can be unambiguously traced back to their original definition, and that logical comparisons, matching and inferences can be performed consistently by different systems. For this reason, choice of the correct URI for the system attribute is critical.

The correct value to use in the *system* for a given code system can be determined by working through the following list, in order:

* the specification [Code System Registry](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html) - if a code system is listed here, it SHALL be used
* A system URI or OID defined as the correct value to use in FHIR by the publisher of the code system
* the FHIR [community code system registry](http://registry.fhir.org/NamingSystem) - if a code system is listed here with [status = active](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\namingsystem-definitions.html#NamingSystem.status), it SHALL be used
* an OID registered in the [HL7 OID registry](http://hl7.org/oid) - if a code system is registered here, the OID SHOULD be used (using the syntax urn:oid:[oid])

If a code system is resolved by this list, and there is no publisher to consult, implementers will have to choose a URI to use. The priority should be to choose a unique value that won't accidently be used by another implementer for a different purpose - or a very similar purpose with a different scope.

For publishers of code systems, the following considerations should be kept in mind when defining the correct URI to use:

* Once defined, the URI will require agreement from all implementers to change, and some may not be able to change (stored resources). If the set of users is not closed, it will usually not be possible to change the URI
* Implementers strongly prefer a human readable URI. http://acme.com/patients/mrn is a great deal easier to work with than urn:oid:1.2.3.4.5.6.7
* An http: address SHOULD resolve to some useful description of the code system. Ideally, if a user makes a request of the address with the media type set to a FHIR media type, the server will respond with a FHIR Value Set resource with an inline [code system](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-definitions.html#ValueSet.codeSystem), but some other human or computable definition is allowed
* http addresses should be permalinks which may re-direct to the current correct content
* A scope of the code system URI and the correct usage of codes and displays in its namespace SHOULD be clearly defined. See examples for [SNOMED CT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html), [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html), [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html), [NDC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\ndc.html)
* Generally, allocation of URLs is heirarchical, and most care is required in choosing the root URL. One sub-URL policies are clearly defined, URIs can often be automatically assigned

Note: if the code system is made available packaged inside a [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) resource, the correct URL for the system value is *ValueSet.codeSystem.system*, not *ValueSet.uri*.

## Controlling the use of Coded Values

When an element is bound to a value set, the binding has these properties:

|  |  |
| --- | --- |
| Name | A descriptive name used when presenting information about the binding |
| Strength | How the binding should be understood - see below |
| Reference | A URL that defines the value set. Usually, this is a direct reference to a [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) resource, but can be a more indirect reference, where the value set is inferred |
| Description | A text description of the use of the codes. If there is no reference, this must be populated. When there is a reference, this can be used to make additional notes about the use and implementation of the value set |

In the FHIR declarative datatypes, a binding is always represented using an [ElementDefinition.binding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-definitions.html#ElementDefinition.binding).

### Value Set References

There are a number of places in the specification where value sets are referenced in order to bind a coded value to a value set:

|  |  |
| --- | --- |
| [ElementDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition.html).binding.valueSet[x] | Used to bind a defined element to a value set |
| [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html).source[x] and .target[x] | used to indicate the scope of the mapping in the Concept Map - from one value set to another |
| [Questionnaire](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\questionnaire.html).group.question.options | Indicates that answers to a set of questions come from a value set |
| [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html).compose.import | The content of a value set includes the content in the imported value set too |
| [ValueSet Reference Extension](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-valueset-reference.html) | Indicates that a particular coded value was chosen from the specified value set |

There are two types of value set references in this list, direct and logical.

#### Direct Value Set references

A direct value set reference has the type [Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#Reference), and refers directly to a ValueSet based on a URL, usually to a terminology server running a [FHIR RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html). When accessing a value set based on this kind of reference, a system should access the URL directly (after converting a relative reference to an absolute reference according to the local context). If this process fails, the system is unable to resolve the value set and must handle the error appropriately.

Example:

GET fhir/Questionnaire/234

<Questionnaire>

...

<question>

<options>

<reference value="ValueSet/234234"/>

</options>

</question>

....

</Questionnaire>

This specifies that the values for a particular questionnaire come from the ValueSet with id 234234 on the same FHIR end-point. To resolve this, the system would GET fhir/ValueSet/234234

Typically, a direct reference like this is good for in-process references, in closed or carefully managed eco-systems. In a more general context, these references tend to be fragile over time because web URLs - including RESTful API URLS - are easily reassigned. For this reason, systems are encouraged to use logical value set references.

#### Logical Value Set references

A logical value set reference has the type [uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri), where an absolute URI is provided that matches the one in ValueSet.url. The value set URL can - and is preferred to be - a web address that actually resolves directly to a fixed web address that serves as the authoritative source for that value set. Alternatively, the system can query its terminology server(s) to resolve a value set with that URL as its identity.

Example:

<StructureDefinition>

...

<element>

...

<binding>

...

<valueSetUri value="http://hl7.org/fhir/ValueSet/clinical-findings"/>

</binding>

...

</element>

....

</StructureDefinition>

This specifies that the element is bound to the value set with a Value.url of <http://hl7.org/fhir/ValueSet/clinical-findings>. One way to accees this value set is to try GET http://hl7.org/fhir/ValueSet/clinical-findings - which works, for this value set - http://hl7.org/fhir/ValueSet/clinical-findings returns the authoritative value set for this URL.

Alternatively, the value set could be resolved using a local terminology server. If that's running a [FHIR Terminology Server](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminology-service.html), then this would work like this:

GET fhir/ValueSet?url=http://hl7.org/fhir/ValueSet/clinical-findings

if the terminology server knows the value set, then it will return the value set. If the URL doesn't resolve to an authoritative value set, and the terminology server(s) don't know the value set, the system is unable to resolve the value set and must handle the error appropriately.

The value set URL is allowed to be a URI such as a UUID (e.g. urn:uuid:c0e0d027-1250-4278-8f44-33a49dc67916). These value sets can never be accessed directly, and must come from a terminology server. Note that this specification defines many value sets that have a logical URL that is not resolvable (examples for [SNOMED CT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html#implicit), [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html#implicit), [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html#implicit))

Using a logical reference which is a direct reference to the authoritative value set is the easiest and most reliable approach. However this requires suitable hosting arrangements, and cannot always be guaranteed, so it is not required.

**Version specific Logical References**

A value set has a two part identifier: a url, and a version. Some value sets only ever have a single 'version'; a revision of the value set contents will cause a new url to be assigned. Others, however, maintain the same URL, and change the version. A terminology server may have multiple value sets for the same ValueSet.url with different versions.

To be precise about which version of a value set is being referred to in a value set reference, append the the version to the logical url like this:

<valueSetUri value="http://hl7.org/fhir/ValueSet/clinical-findings?version=0.8"/>

This is a version specific reference to a value set. Searching for this on a terminology server would look like this:

GET fhir/ValueSet?url=http://hl7.org/fhir/ValueSet/clinical-findings&version=0.8

Note that if a value set reference does not have a version, and the server finds multiple versions for the value set, the system using the value set should pick the latest version of the value set and use that.

#### Unbound

Note that as a matter of ongoing development, a few elements that have coded data types are not bound to any value set at all. Bindings are to be provided for these elements.

## Binding Strengths

Almost all of the elements that have a coded data type are bound to a value set. The bindings are associated with various degrees of flexibility as to how closely the value set should be followed:

|  |  |
| --- | --- |
| required | To be conformant, instances of this element SHALL include a code from the specified value set |
| extensible | To be conformant, instances of this element must include a code from the specified value set if any of the codes within the value set can apply to the concept being communicated. If the valueset does not cover the concept (based on human review), alternate codings (from different code systems, including local ones) or (data type allowing) text) may be included instead. |
| preferred | Instances are encouraged, to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant |
| example | Instances are not expected or even encouraged to draw from the specified value set. The value set merely provides examples of the types of concepts intended to be included |

Irrespective of the binding strength, when a [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) is used to describe local usage, it can bind the element to a different value set in order to be much more precise about exactly which coded values can be used for these elements, and/or increase the strength of the binding. There are different rules for this, depending on the binding strength, as discussed below. Generally it is expected that jurisdictions, projects and vendors will work together to choose actual working value sets.

### Required

*To be conformant, instances of this element SHALL include a code from the specified value set.*.

In the standard, this is generally used for elements where the value needs to be strictly controlled so that everyone can interpret it with confidence. Generally, this is used for elements with type [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code):

* the element is bound to a value set that contains a list of distinct codes with a specified system (and version, where required)
* the element is bound to some external standard that defines the set of valid codes that can be used (typical examples of references are [Mime Types](http://www.rfc-editor.org/bcp/bcp13.txt), [Language Codes](http://tools.ietf.org/html/bcp47), [UCUM](http://unitsofmeasure.org), etc.)

The other place where this is used is when [profiling resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html), and there is agreement within a particular context of use that a particular set of codes are the only ones that can be used. In these cases, the data type SHALL contain one of the values in the value set. If the data type is [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), then one of the *coding* values SHALL be from the specified value set. *Text* can be provided as well, and is always recommended, but is not an acceptible substitute for the required code.

Note the following additional rules about required bindings when used with the [code](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#code) data type:

* Where the value set is defined by FHIR, the list of allowed codes will be fixed in the XML schema
* Comparison between codes is always case sensitive for codes unless the codes are selected by reference (e.g. ValueSet.compose), and the referenced specification clearly states otherwise
* The list of codes that can be used can only be extended in subsequent releases of the FHIR specification

When an element is bound to a required value set, [derived profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) may state rules on which codes can be used, but cannot select new or additional codes for these elements.

### Extensible

*To be conformant, instances of this element SHALL include a code from the specified value set if any of the codes within the value set can apply to the concept being communicated. If the valueset does not cover the concept (based on human review), an alternate system.code may be used instead.*

If the data type is [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), then one of the *coding* values SHALL be from the specified value set if a code applies, but if no suitable code exists in the value set, alternate code(s) may be provided in its place. If no codes, including local codes, are available, then just text may be used.

If the data type is [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding), then the code/system SHALL be from the specified value set if a code applies, but if no suitable code exists in the value set, an alternate code may provided in its place.

Identified gaps in value sets should be submitted to the organization administering the value set in order to improve interoperability in the future.

Extensible bindings are used when there is consensus at the specification or profiling level about the coded values that should be used, but it is impossible to create a bounded list of codes that a known to cover all use cases, including one that are yet to arise.

When an element is extensibly bound to value set, [derived profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) may state rules on which codes can be used, but cannot select new or additional codes for these elements unless no codes with appropriate meanings are found in the base value set.

### Preferred

*Instances are encouraged to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant.*

If the data type is [CodeableConcept](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#CodeableConcept), then one of the *coding* values SHOULD be from the specified value set, but another code and/or text can be used in its place.

Preferred bindings are used when there is consensus at the specification level about the coded values that are the best to be used, but there is recognition that some implementation contexts are unable to use the recommended codes for a variety of reasons. Applications should consider adopting the preferred value set where ever possible, as these preferred value sets are the most likely to server interoperability purposes in the future.

When an element is bound to a preferred value set, [derived profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) may bind the element to any value set they choose.

#### Example Bindings

*Instances are not expected or even encouraged to draw from the specified value set. The value set merely provides examples of the types of concepts intended to be included.*

Example bindings are used when an element has a very broad meaning (such as [List](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\list.html).code), or there is no consensus over the correct codes to be used. For these bindings:

* **Coding**: the *system*/*code* values MAY be one of the codes in the value set.
* **CodeableConcept**: one of the *coding* elements MAY contain a *system*/*code* that is in the value set.

Some other coded value MAY be used, or (for a CodeableConcept), a text alternative MAY be provided. Example value sets are provided to assist implementers to understand the correct use of an element. Value sets based on code systems such as SNOMED CT that have restrictive license terms will only be used as example bindings in the base FHIR specification, though implementation guides for particular jurisdictions may adopt value sets that require licenses.

When an element is bound to an example value set, [derived profiles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html) may bind the element to any value set they choose.

## Other notes

* Subsequent versions of FHIR may replace example value sets with preferred bindings if enough consensus emerges in the space
* Bindings to value sets provided as part of the specification are always specific to the version of the value set published with the specification. The value set may be sealed by defining a simple list of enumerated codes, or it may include codes by their properties, along with a non-version specific reference to an underlying code system, in which case the list of valid concepts may change over time.

### Binding String Values

In a few special cases, humans customarily use codes directly for elements that have type "string". A typical case is codes for states, and there are several places where a URIs must come from a set of controlled values. An element of type [string](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#string) or [uri](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#uri) can also be bound to a value set. When a string or URI is bound to a value set, the value property SHALL contain the code specified by the value set, and the system and display values are ignored.

# terminology-service.html

## Terminology Service

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This specification includes support for the provision of a terminology service - that is, a service that lets healthcare applications make use of codes and value sets without having to become experts in the fine details of the value set resource, and the underlying code systems. A server that supports all the functionality described here can be described as a "FHIR Terminology Service", and SHALL conform to [this conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-terminology-server.html).

### Security

Generally, SSL SHOULD be used for all production health care data exchange. Even though terminology servers do not directly handle patient information, hackers may still be able to infer information about patients by observing the codes and concepts that the terminology service is asked about, so encryption is still recommended.

A terminology server may choose not to authenticate the clients/users in any fashion, but can do so in order to limit or account for usage. For a value set maintenance server that allows terminologies to be edited, some form of [authorization and/or authentication would be appropriate](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html). This specification does not require any particular approach to security.

### Basic Concepts

A FHIR terminology service is simply a set of functions built on the definitions provided by a set of [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) and [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) resources, with additional inherently known terminologies providing support.

The terminology service builds on the basic principles for using terminologies in FHIR. Implementers should be familiar with:

* [Using codes in FHIR](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html)
* The [ValueSet](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) resource
* The [ConceptMap](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap.html) resource

In addition, implementers should be familiar with the [operations framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html). Further useful information may be found in:

* Underlying Principles: [V3 Core Principles](http://www.hl7.org/documentcenter/public/standards/V3/core_principles/infrastructure/coreprinciples/v3modelcoreprinciples.html)
* SNOMED CT [technical documentation](http://ihtsdo.org/fileadmin/user_upload/doc/). Note: "namespace" is used differently here from the way it is used by IHTSDO (see [discussion here](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies.html))

#### External Code Systems

In order to be used with a value set, code systems must be defined somewhere. They can be defined as part of an [inline code system definition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html#codeSystem), or they can be defined elsewhere, and then used in a value set by quoting the correct namespace. The FHIR specification defines a [set of namespaces](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\terminologies-systems.html) for commonly encountered code systems, and defines how some work with FHIR (e.g. [SNOMED-CT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html), [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html), [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html)). These code systems are often large, and have many internally defined properties that are part of their formal definitions. Inline code systems in Value Set resources are not an appropriate way to define these code systems; FHIR does not provide a formal representation at all. Instead, these terminologies provide their own distribution formats, and it is assumed that they are externally known to the terminology server.

Most useful terminology servers will make one or more of these external code systems available for use within the value sets that they manage. The list of additional terminologies that a terminology server supports beyond those defined in its value sets is published to clients by (still to figure out how this works).

A server SHOULD publish the additional code systems that it supports through intrinsic knowledge using the [http://hl7.org/fhir/StructureDefinition/conformance-supported-system extension:](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extension-conformance-supported-system.html)

{

"resourceType" : "Conformance",

"extension" : [

{

"url" : "http://hl7.org/fhir/StructureDefinition/conformance-supported-system",

"valueUri" : "http://loinc.org"

}]

}

This extension is added to the root [Conformance Statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html).

#### Implementation Note

When a terminology server exposes an external code system, it makes a set of services available internally that serve the operational interfaces below. The internal server depends on the following logical information for a terminology:

* its URL (namespace, and how versioning works)
* what codes are valid
* what properties can be used to select codes
* what implicit value sets exist

The FHIR specification itself defines these things for common terminologies (including [SNOMED-CT](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\snomedct.html), [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html), [RxNorm](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\rxnorm.html)), and provides the Value Set infrastructure for supporting typical relatively simple small code systems.

*Implementers Note: Implementers interested in working with existing published terminologies for which the Value Set infrastructure is not suitable should discuss their needs with HL7 to get the list above extended.*

Note: A terminology service may choose to expose additional external code system specific related functionality such as exploration, or structured search, but these services are outside the scope of the FHIR terminology service.

#### Operations across all value sets

For some of the operations below, it can be useful to perform them across all value sets known to the system. For example, $expand using a text filter, and searching all value sets at once. A special value set is defined that means "all value sets known to the server":

http://hl7.org/fhir/ValueSet/@all

Technically, this value set automatically imports all the existing value sets on the server. Note that this URL has no fixed meaning - its interpretation is server specific. This URL can only be used as a parameter to the operations described on this page.

#### Terminology Maintenance

The terminology service uses the value set resources defined on the system - both the implicit ones associated with the external code systems and those explicitly available at the /ValueSet endpoint - to serve the operational interface defined below. As value sets are created, updated or deleted, the outcomes of the operational services change. A terminology server should validate incoming resources, and ensure integrity of the terminology services. Typically, servers would provide a test and production environment, but there is no explicit notion of this in the interface itself.

### Value Set Expansion

A value set describes a set of rules for what codes or concepts are considered to be in the value set. These rules might be simple (e.g. a direct list of codes from a specified version of a code system), or they might be quite complex (e.g. all codes with a particular property from an unspecified version of a code system).

A FHIR enabled application can simply ask the server to figure out all the details, and return it a list of the current codes in the value set. This is known as ["expanding" the valueset](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-operations.html#expand). As a summary, the client passes the server the following information:

* the value set (either by its URL on the RESTful interface, by its logical identifier [(ValueSet.url)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-definitions.html#ValueSet.url), or directly as a parameter to the call)
* (Optionally) a text filter to use to restrict the codes that are returned (e.g. user input text). It is left to server discretion to choose how to apply the text filter
* (Optionally) a date at which the expansion should be evaluated (usually, this is the current date/time, but there are circumstances where that is not appropriate)
* (Optionally) which page to retrieve - asking the server to break the expansion into a set of chunks

The server returns a value set that contains the current list of codes that meet the filter criteria (or an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) with an error if the expansion fails). Note that some value sets expand to many thousands of codes, or even an infinite number, and for these, the server SHOULD return an [error code *too-costly*](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-issue-type.html#too-costly). In these cases the client can try again with a more specific text filter to reduce the number of codes returned.

For further information, consult the [definition of the operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-operations.html#expand).

The $expand operation has support for paging - for a client to retrieve a big expansion in a set of partial views, in order to present the most optimal user experience. The client specifies both an offset and a count - how many codes per page, and where in the sequence to start. The return expansion specifies the number of concepts in the expansion, and the offset at which this partial view starts. Note that all expansions SHOULD include the total code count, but the offset element SHALL only exist when paging is being used. Expansions that are heirarchical trees of concepts are not subject to paging, and the server simply returns the entire expansion.

Some example uses for the expansion operation:

* get a list of codes to display in a User interface (e.g. a drop down interface)
* a variation on this is to offer the user a text box to type in. As the user types, call the expand operation to provide the user with a list of matching codes/concepts (like a browser search)
* fetch a list of codes to use when generating software programming instructions
* get a list of codes so that software can check whether a code is valid or not in a particular context

**Examples**

Expanding a value set that is already registered on the server as "23", with a text filter of "abdo" :

GET [base]/ValueSet/23/$expand?filter=abdo

Expanding a value set that is specififed by the client (using JSON):

POST [base]/ValueSet/23/$expand

[other headers]

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "valueSet",

"resource" : {

"resourceType" : "ValueSet",

[value set details]

}

}

]

}

The server responds with a value set (this example in XML):

HTTP/1.1 200 OK

[other headers]

<ValueSet xmlns="http://hl7.org/fhir">

<!-- the server SHOULD populate the id with a newly created UUID

so clients can easily track a particular expansion -->

<id value="43770626-f685-4ba8-8d66-fb63e674c467"/>

<!-- no need for meta, though it is allowed for security labels, profiles -->

<!-- other value set details -->

<expansion>

<!-- when expanded -->

<timestamp value="20141203T08:50:00+11:00"/>

<contains>

<!-- expansion contents -->

</contains>

</expansion>

</ValueSet>

### Concept Lookup

A system can ask a terminology server to return a set of information about a particular system/code combination using [the lookup operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-operations.html#lookup). The server returns information for both display and processing purposes. The client passes the server the following information:

* the code value (either a code+system, or a Coding data type
* (Optionally) a date at which the code information should be returned (usually, this is the current date/time, but there are circumstances where that is not appropriate)

The server returns the following information:

* A human description of the system
* A recommended display for the code
* Whether the code is abstract or not
* Other designations for the code (a value, optionally with language and/or a use code)

The recommended display to the code is a text representation of the code that the terminology server recommends as the default choice to show to the user, though a client may choose out of the other designations if it has reason to.

**Examples**

Looking up a code/system :

GET [base]/ValueSet/$lookup?system=http://loinc.org&code=1963-8

Lookup using a Coding (this example in XML):

POST [base]/ValueSet/$lookup

[other headers]

<Parameters xmlns="http://hl7.org/fhir">

<parameter>

<name value="coding"/>

<valueCoding>

<system value="http://loinc.org"/>

<code value="1963-8"/>

</valueCoding>

</parameter>

</Parameters>

The server responds with a set of information (JSON this time):

HTTP/1.1 200 OK

[other headers]

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "name",

"valueString" : "LOINC"

},

{

"name" : "version",

"valueString" : "2.48"

},

{

"name" : "designation",

"valueString" : "Bicarbonate [Moles/volume] in Serum"

},

{

"name" : "abstract",

"valueString" : "false"

},

{

"name" : "designation",

"part" : [

{

"name" : "value",

"valueString" : "Bicarbonate [Moles/volume] in Serum "

}

]

}

]

}

### Value Set Validation

One of the ways to determine whether a code is in a value set is to expand the value set (as described above), and then look at the returned codes to see if the code is in the expansion. However this is not an efficient way to test whether a code is valid, and for some value sets (e.g. with infinite number of members), it cannot work. Instead, a FHIR terminology server provides [a "validate-code" operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-operations.html#validate-code). The client passes the server the following information:

* the value set (either by its URL on the RESTful interface, by its logical identifier [(ValueSet.url)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset-definitions.html#ValueSet.url), or directly as a parameter to the call)
* the code value (either a code+system, a Coding data type, or a CodeableConcept
* (Optionally) a date at which the expansion should be evaluated (usually, this is the current date/time, but there are circumstances where that is not appropriate)

The server returns a true/false indicating whether the code/concept is valid, and a list of errors and warnings associated with it. The server should also return an appropriate display for the concept for use in a UI context.

Note that if the server is passed a CodeableConcept, the server is able to check whether any of the codes are valid against the value set, and also check whether multiple codings are allowed and/or the codings provided are consistent with each other.

Every code system has an implicit value set that is "all the concepts defined in the code system". For some code systems, these value set URIs are defined in advance (e.g. for [LOINC](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\loinc.html), it's http://loinc.org/vs). However for some code systems, they are not known. Clients can refer to these implicit value sets by providing the URI for the code system itself.

**Examples**

Simple validation of a code/system against a known value set:

GET [base]/ValueSet/23/$validate-code?system=http://loinc.org&code=1963-8&display=test

Validate a CodeableConcept against a client specified value set (this example in JSON):

POST [base]/ValueSet/$validate-code

[other headers]

{

"ResourceType" : "Parameters",

"parameter" : [

{

"name" : "coding",

"valueCodeableConcept" : {

"coding" : {

"system" : "http://loinc.org",

"code" : "1963-8",

"display" : "test"

}

}

},

{

"name" : "valueSet",

"resource": {

"resourceType" : "ValueSet",

[etc]

}

}

]

}

The server responds with validation information (JSON this time):

HTTP/1.1 200 OK

[other headers]

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "result",

"valueBoolean" : "false"

},

{

"name" : "message",

"valueString" : "The display \"test\" is incorrect"

},

{

"name" : "display",

"valueString" : "Bicarbonate [Moles/volume] in Serum"

}

]

}

### Subsumption testing

The Expand and Validate operations can be used to perform subsumption testing. To test whether *code A* subsumes *code B*, perform a validate specifying a value set built of all the codes that are subsumed by *code A*, and test whether *code B* is subsumed by it. Note that a server is allowed (and SHOULD, but is not required to) consider concept maps when doing subsumption testing. E.g. if A is a LOINC code, and it has a precise mapping to a SNOMED CT code that subsumes B, with an appropriate scope, then the server can indicate that this it is true that LOINC code A subsumes SNOMED CT code B.

In order to make it convenient to perform this subsumption testing, code systems that define subsumption hierarchies should define simple URLs to express a value set that includes all the codes subsumed by a code.

**Examples**

Test whether a Snomed Concept 399211009 (History of myocardial infarction) is subsumed by 22298006 (Myocardial infarction):

GET [base]/ValueSet/$validate-code?system=http://snomed.info/sct&code=399211009&identifier=http://snomed.info/sct?fhir\_vs%3Disa/22298006

Server response:

HTTP/1.1 200 OK

[other headers]

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "result",

"valueBoolean" : "false"

},

]

}

### Batch Validation

It's also possible to validate a set of concepts against their relevant value sets by using the $validate-code operation in a [Batch](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#batch) interaction.

**Example**

A request to validate 2 concepts from a CDA document, with OIDs for value set identifiers:

POST [base]

[other headers]

{

"ResourceType": "Bundle",

"type": "batch",

"entry": [{

"request": {

"method": "Get",

"url": "ValueSet?system=http://loinc.org&code=2324-4&uri=urn:oid:1.2.3.4.6"

}

},

{

"request": {

"method": "GET",

"url": "ValueSet?system=http://snomed.info/sct&codes=22298006&uri=urn:oid:1.2.3.4.7"

}

}]

}

The server responds with a series of validation outcomes (JSON this time):

HTTP/1.1 200 OK

[other headers]

{

"ResourceType": "Bundle",

"type": "batch-response",

"entry": [{

"resource": {

"resourceType": "Parameters",

"parameter": [{

"name": "result",

"valueBoolean": "false"

},

{

"name": "message",

"valueString": "'2324-4' is not a valid LOINC code"

}]

}

},

{

"resource": {

"resourceType": "Parameters",

"parameter": [{

"name": "result",

"valueBoolean": "false"

},

{

"name": "message",

"valueString": "The concept is not in the specified value set (\"Organisms\")"

},

{

"name": "display",

"valueString": "Myocardial infarction"

}]

}]

}

### Translations

A client can ask a server to translate a concept from one value set to another. Typically, this is used to translate between code systems (e.g. from LOINC to SNOMED CT, or from a v3 code to a v2 code). The client calls [the translate operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap-operations.html#translate) and passes the following parameters:

* A code+system, Coding, or CodeableConcept
* A Concept Map to use for the translation
* The value set for the context of the source
* The value set for the destination

The client passes either a concept map, or the value sets for the source and destination context. If there is no concept map, then the server may determine the appropriate map to use from context provided in the value sets. If there is no particular context, the appropriate value sets would be the value sets for the entire coding system at question (e.g. from http://snomed.info/sct to http://loinc.org/vs). The server performs the translation as it is able based on the concept maps that it knows about. If no single mapping can be determined then the server returns an error. Some servers may require a concept map to use for the translation.

**Example**

Translate from FHIR Composition status to V3 Act Status (based on [this defined concept map](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition-status-map-v3.html):

GET [base]/ConceptMap/$translate?system=http://hl7.org/fhir/composition-status

&code=preliminary&valueSet= http://hl7.org/fhir/ValueSet/composition-status

&target=http://hl7.org/fhir/ValueSet/v3-ActStatus

The server responds with validation information:

HTTP/1.1 200 OK

[other headers]

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "result",

"valueBoolean" : "true"

},

{

"name" : "outcome",

"valueCoding" : {

"system" : "http://hl7.org/fhir/v3/ActStatus",

"code" : "active",

}

}

]

}

### Batch Translation

It's also possible to validate a set of concepts against their relevant value sets by using the $translate operation in a [Batch](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#batch) interaction.

**Example**

A request to translate 2 concepts from a CDA document, with OIDs for value set identifiers:

POST [base]

[other headers]

{

"ResourceType": "Bundle",

"type": "batch",

"entry": [{

"resource": {

"ResourceType": "Parameters",

"parameter": [{

"name": "concept",

"valueCodeableConcept": {

"system": "http://loinc.org",

"code": "2324-4"

}

},

{

"name": "target",

"valueUri": "urn:oid:1.2.3.4.6"

}]

},

"request": {

"method": "POST",

"url": "ConceptMap/$translate"

}

},

{

"resource": {

"ResourceType": "Parameters",

"parameter": [{

"name": "concept",

"valueCodeableConcept": {

"system": "http://snomed.info/sct",

"code": "22298006"

}

},

{

"name": "target",

"valueUri": "urn:oid:1.2.3.4.7"

}]

},

{

"request": {

"method": "POST",

"url": "ConceptMap/$translate"

}

}]

}

The server responds with a series of translation outcomes:

HTTP/1.1 200 OK

[other headers]

{

"ResourceType": "Bundle",

"type": "batch-response",

"entry": [{

"resource": {

"resourceType": "Parameters",

"parameter": [{

"name": "result",

"valueBoolean": "false"

},

{

"name": "message",

"valueString": "'2324-4' is not a valid LOINC code"

}]

}

},

{

"resource": {

"resourceType": "Parameters",

"parameter": [{

"name": "result",

"valueBoolean": "false"

},

{

"name": "outcome",

"valueCodeableConcept": {

"coding": {

"system": "http://example.com/codesystems/example",

"code": "xxxx"

}

}

}]

}

}]

}

### Maintaining a Closure Table

The 4 operations Expand, Lookup, Validate, and Translate account for most operational requirements associated with terminology use. However there is one difficult but important use case that they do not address, which is integrating terminologically based logic into application search.

A typical example of this is a user that wants to find any observations for male patients over the age of 50 who attended a particular clinic within a particular 2 week period, with a diagnosis of gout, and who had an elevated serum creatinine.

In this case, both "diagnosis of gout" and "serum creatinine" involve valueset and/or subsumption queries (e.g. against SNOMED CT and LOINC respectively). This search has to be executed by some logical processing engine that knows how to find this data in a given persistence store. Often, this is some kind of SQL query, though many other technological choices are available. However this is done, the challenge with an operation like this is to integrate the terminological knowledge into a search execution that also covers other relationships expressed in the search criteria.

One approach to this problem would be to using the expand operation above, so that the system executing the search could generate expansions, and then search for these expansions. This has a couple of problems:

* the list of subsumed codes could be very long, and the search operation becomes correspondingly inefficient
* the expansion of the subsumption might not be closed, and so the search operation can't be correct

An alternative approach is to generate a subsumption [closure table](http://karwin.blogspot.com.au/2010/03/rendering-trees-with-closure-tables.html), which lists all the possible relationships, and allows for rapid execution of these kind of queries. However this has other problems:

* the subsumption table can be very large (>500000 records for SNOMED CT), even though very few of the codes are used
* subsumption tables are generally built up front, and don't deal with new codes as they are encountered very well
* they still don't offer a solution for non-closed expansions

This is the main reason why most systems don't support post-coordination or other forms of coded expressions.

In FHIR, this problem is solved by building a closure table on the fly, as new codes are seen. This technique leaves the FHIR terminology server responsible for the terminological reasoning, and the client responsible for the closure table maintenance. To the client, it doesn't matter whether the concept is post-coordinated or not. Here's a description of how the process works:

1. The client defines a name associated with a particular context in which it wishes to maintain a subsumption based closure table.
2. The client registers this name with the FHIR Terminology server using the $closure operation (described below), with only one parameter, the name of the context
3. any time the client system encounters a new Coding that isn't entered in the closure table, it calls the $closure operation with the context name, and the Coding value it has encountered
4. the server returns a ConceptMap resource with a list of new entries (code : system -> code : system) that the client should add to its closure table
   * the server can indicate that entries should be removed from the table by providing a (code : system -> code : system) with equivalence "unmatched" (though it's not known why that would be needed)
5. The client makes these entries into its closure table
6. to facilitate the initialization process, a client can call $closure with multiple Coding values

The [$closure operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conceptmap-operations.html#closure) takes 2 parameters:

* Closure table context name
* Coding to enter into the table (0 or more - 0 codings is a request to (re-)initialise the table)

The operation returns a concept map which has a list of mappings that represent new entries to make in the closure table.

The closure table can be resynchronized by passing an additional "version" parameter, which is a value taken from the version in one of the delta responses. This is a request to replay all the mapping changes since that delta was sent.

**Example**

The client sees a new SNOMED CT concept "22298006" in a data element it is tracking as "patient-problems":

POST [base]/$closure

{

"resourceType" : "Parameters",

"parameter" : [

{

"name" : "name",

"valueId : "patient-problems"

},

{

"name" : "concept",

"valueCoding" : {

"system" : "http://snomed.info/sct",

"code" : "22298006",

}

}

]

}

The server responds with a set of new entries to add to the concept map. It provides one important piece of metadata - the version, which the client can use to resynchronize the closure table:

HTTP/1.1 200 OK

[other headers]

{

"resourceType": "ConceptMap",

"identifier": "49088976-d54d-4d19-b868-3d4c18cebabb",

"version": "8",

"status": "active",

"experimental": true,

"date": "2012-06-13",

"element": [

{

"codeSystem": "http://snomed.info/sct",

"code": "22298006",

"map": [

{

"codeSystem": "http://snomed.info/sct",

"code": "128599005",

"equivalence": "wider"

}

]

},

]

}

Notes:

* In this simple example, the addition of a single new SNOMED CT concept created one existing subsumption relationship. In general clinical use, more than one relationship would be expected
* For the purposes of the closure table, the relationships are considered to be bi-directional; e.g. if A subsumes B, then B is subsumed by A
* As well as entering codes that are actually used, the client also enters search terms into the closure table
* The combination of the system and code is the key to the closure table; if the server encounters two different codes that have the same meaning (e.g. syntactical variation), it should create an "equals" relationship between them

The client uses the result of the closure operation to maintain a closure table. Simplistically, it might look like this:

|  |  |  |  |
| --- | --- | --- | --- |
| **Scope** | **Source** | **Target** |  |
| patient-problems | http://snomed.info/sct|22298006 | http://snomed.info/sct|128599005 |  |
| patient-problems | http://snomed.info/sct|24595009 | http://snomed.info/sct|90560007 |  |
| obs-code | http://loinc.org|14682-9 | http://loinc.org|LP41281-4 |  |

The client can then use a table like this as part of its general search conditions. Using the example from above: "Find any observations for male patients over the age of 50 who attended a particular clinic within a particular 2 week period, with a diagnosis of gout, and who had an elevated serum creatinine." This query could be done, for instance, with an SQL query like this:

Select \* from Observations, Patients, Encounters, Conditions, Observations as Obs2 where

Observations.patient = Patients.Key and Patients.Age > 50 and

Observations.encounter = Encounters.Key and Encounter.clinic = [key]

and encounter.date >= [date] and encounter.date <= [date] and

Conditions.patient = Patients.Key and Conditions.code

in (select Source From ClosureTable

where Scope = "patient-problems" and Target = "http://snomed.info/sct|90560007") and

Obs2.patient = Patients.Key and Obs2.value > 0.19 and Obs2.code

in (select Source From ClosureTable

where Scope = "obs-code" and Target = "http://loinc.org|LP41281-4")

Note that in real clinical systems, tables are usually far more structured than this example implies, and the query is correspondingly more complex. The closure table would usually be normalised - this example is kept simple to demonstrate the concept.

### Functional Operations

In order to support terminology operations in FHIR a minimal set of terminology operations would be necessary. These operations are a sub set of the available terminology service operations defined in the [http://www.omg.org/spec/CTS2/1.0/ Common Terminology Services - Release 2 (CTS2) specification] and can be categorized as:

* Administrative Operations
* Search/Query Operations
* Authoring/Maintenance Operations

Functional operations within these categories support the access and management of terminology objects such as Code Systems, Concepts, Value Sets and Concept Mappings. The functional operations necessary to support a FHIR terminology service are outlined here.

#### Administrative Operations

* Be able to load a standard or local code system

#### Search/Query Operations

Concepts

* Retrieve the concept details (display name, qualifiers, associations, etc.) for a given code/code system
* Return possible concept matches based on search criteria
* Validate whether a code is valid within a given code system (content)
* Retrieve a list of codes (for example, to populate a user interface)
* Return the decedents of a given concept

Code System

* Retrieve the metadata for a code system

Value Set

* Retrieve the metadata for a value set
* Return a value set based on search criteria
* Determine if a code is valid in a value set
* Generate the Value set Expansion from the Value Set Definition.

Mapping

* Retrieve the metadata for map set
* Retrieve a translation (mapping) of concept(s) from a given source code system to target concept(s) from a target code system

#### Authoring/Maintenance Operations

Concepts

* Maintain a closure table

Value Set

* Create/editing a value set

Mapping

* Translate (map) from a source code system to a target code system

# timelines.html

## FHIR Timelines

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR is a standard. In order to be useful, standards need to evolve. At the same time, the evolution of standards needs to be predictable and manageable for the implementation community. This section provides forward-looking statements about the expected pattern of FHIR releases as well as the degree of stability and change implementers should expect from the standard as it continues to evolve.

### Standard Levels

FHIR has three descriptive terms that describe the level of stability and implementation readiness associated with different aspects of the specification. They are as follows:

|  |  |
| --- | --- |
| **Standard Level** | **Description** |
| **Draft** | This portion of the specification is not considered to be complete enough or sufficiently reviewed to be safe for implementation. It may have known issues or still in the "in development" stages. It is included in the publication as a place-holder, to solicit feedback from the implementation community and/or to give implementers some insight as to functionality likely to be included in future versions of the specification. Content at this level should only be implemented by the brave or desparate and is very much "use at your own risk". This version of the specification is a draft that will be elevated to DSTU once review and correction is complete after ballot |
| **Draft Standard for Trial Use (DSTU)** | This content has been well reviewed and is considered by the authors to be ready for use in production systems. It has been subjected to ballot and approved as an official standard. However, it has not yet seen widespread use in production across the full spectrum of environments it is intended to be used in. In some cases, there may be documented known issues that require implementation experience to determine appropriate resolutions for. For these reasons, DSTU content is not subject to FHIR [Inter-version Compatibility Rules](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\compatibility.html). Future versions of FHIR may make significant changes to DSTU-level content that are not compatible with previously published content. See [DSTU suggestions](#dstu) for implementation strategies to help manage the risk of non-compatible future changes. |
| **Normative** | This content has been subject to review and production implementation in a wide variety of environments. The content is consdiered to be stable and has been 'locked', subjecting it to FHIR [Inter-version Compatibility Rules](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compatibility.html). While changes are possible, they are expected to be infrequent and are tightly constrained. |

The above statuses can apply to both the standard overall as well as to individual components of the FHIR specification. Specification components cannot ever have a "higher" standard level than the overall specification, but they can have lower levels. For example, at DSTU, FHIR can include draft content. When it reaches Normative, FHIR may include some content that remains at DSTU or draft levels if that content has not yet reached the criteria for normative. All content that is at a different ballot level than the overall specification will be clearly identified.

### FHIR timeline

New versions of FHIR will be published on a release cycle of aproximately 18-24 months. This frequency is based on the timelines necessary to develop, implement and review new content as well as the time necessary to undertake the formal balloting and reconciliation processes required for ANSI-approved standards. This release cycle also ensures an opportunity to incorporate implementer feedback from earlier versions of the specification into subsequent versions.

In some situations, the FHIR Management Group may authorize a limited-scope release on a shorter timeline where necessary to meet implementer requirements and achievable with available HL7 resources.

This release (DSTU 2) is hoped to be the final publication of the specification at the DSTU level. The subsequent publication of the specification (targeted for 2017) should take the core aspects of the specification and many of the most broadly used resources to Normative level. Whether this timeline will be met will be dependent on uptake and feedback from implementers. This feedback will also govern exactly which resources, profiles and other content become normative. Only content that has been successfully implemented in a wide variety of implementation environments with minimal divergence from the DSTU specification will be candidates for normative.

Once FHIR has reached normative status, subsequent publications will continue on the 18-24 month schedule with subsequent releases introducing additional resources, capabilities and other content as well as migrating existing content from draft to DSTU and DSTU to normative, based on the level of implementation.

### DSTU Suggestions

The FHIR specification is a "Draft Standard For Trial Use" (DSTU). It has been subject to significant review through ballot and other HL7 processes and many aspects of it have been implemented and subjected to interoperability testing through Connectathons and early adoption. However, the degree of testing has varied. Some resources have been well tested in a variety of environments. Others have received relatively little real-world exercise. In general, the infrastructure should be considered to be more stable than the resources themselves. In some cases, there are issues on which input is specifically requested during the DSTU period (see the [Outstanding Issue List](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\todo.html), and known issues will arise after publication (refer to the [FHIR Change Request](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse&tracker_id=677) tracker for details.) Guidance from early implementation will help address these areas.

Regardless of the degree of prior implementation, all aspects of the FHIR specification are potentially subject to change. These changes may be minor (clarifications of definitions, etc.) or major (refactoring of resources, changes to serialization rules, eliminating or adding data types, etc.) There is no commitment to backward or forward compatibility during the DSTU process. Changes will not be made without cause, however the interests of long-term implementability will generally trump the impact on early adopters when determining what changes should be made.

This specification has been promoted to DSTU because it is felt that the specification, as is, is implementable and that more value can be gleaned from implementer experience than from subsequent review as part of the ballot process. Implementers who are willing to accept the risk of change (perhaps for the benefit of early implementation experience, first mover advantage and the ability to leverage FHIR's intrinsic benefits) are encouraged to implement FHIR in real-world systems. However, those implementers should be aware that local adaptations may be necessary to meet real-world requirements. Furthermore, such implementers should architect their solutions to be tolerant of changes to the specification and, where necessary, to manage interoperability with systems that may be using different versions of the specification or different local adaptations.

During the DSTU period, requests for change may be submitted using the HL7 gForge tracker which can be found [here](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse&tracker_id=677). Where possible, updates to the "development" version of the specification will be made in a timely fashion. A list of these proposed changes will be published as a continuously updated supplement to the official DSTU publication. Implementers should be aware that the changes are not considered "official" until such time as they are balloted and approved as part of a subsequent DSTU or Normative publication. Change requests might be fixes to allow implementation, clarifications or enhancements. In addition, HL7 will be developing and introducing additional resources and profiles as part of the FHIR specification.

SDOs and regulatory bodies that are interested in making use of the FHIR specification should feel free to do so, but should consider and plan for the possibility that the specification will evolve and change prior to becoming normative.

A key objective of the DSTU process is gaining feedback from implementers making use of the specification. As well, the HL7 has a need to monitor which portions of FHIR are being implemented in what sorts of environments so as to make an informed decision on when the specification is ready to proceed to Normative status. For this reason, all FHIR implementers are asked to complete a short survey which can be found [here](https://www.surveymonkey.com/s/PXZTY7Z).

This survey will capture contact and other information that will allow the FMG to perform appropriate monitoring of FHIR DSTU usage. Survey information will be kept confidential unless the participant authorizes inclusion of their project in an HL7-maintained wiki page of early implementers. Confidential submissions will be reported in aggregate only.

While implementation of the this DSTU release is occurring, development will be progressing on the next (hopefully Normative) release. This next release will include additional resources, profiles and quality enhancements over the current release. It will also incorporate fixes for issues raised with the [FHIR change tracker](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemBrowse&tracker_id=677). It may be useful for implementers of the DSTU to browse the development release to get a sense of what changes are likely coming and perhaps to find more robust definitions and guidance than are available in the first release. The FHIR development release can be found at [hl7.org/fhir-develop](http://hl7.org/fhir-develop). Some implementers who are dependent on content that exists in a draft release may choose to implement based on a particular snapshot of the development release, though in doing so, they will limit their potential communication partners and would not be considered to be completely FHIR conformant.

# toc.html

## Full Table of Contents

* [Documentation](#tabs-1)
* [Resources](#tabs-2)

# todo.html

## Outstanding Issues

This specification is currently in it's second round of trial use. Much work remains to be done.

Specifically, there are still many outstanding questions about the Request/Fulfillment cycle ([Order](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\order.html)/ [OrderResponse](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\orderresponse.html) and how various statuses and workflows associated with requests, as well as how proposals cascade to plans to orders to downstream/encoded orders, etc. This is a matter of ongoing investigation.

In addition, the following general areas of functionality have been deferred to a future version:

* Adverse Event Reporting
* An alarm resource to represent current issues with the patient (e.g. device created)
* Concern Tracking
* Clinical Studies and Protocols
* Aggregated Data Reporting including Public Health Reporting
* Payment related resources, and specifically, an Account resource for payment tracking
* One or more resources for Advance Care Directive / Power of Attorney
* Use of RDF
* A full server side query framework

For some of these, some draft content is included in the specification as draft for implementer consideration.

In addition, there is a number of specific notes through the specification requesting feedback from implementers:

* [AllergyIntolerance](C:\\Users\\Lloyd\\Documents\\SVN\\FHIR\\build\\qa\\allergyintolerance.html" \l "dstu): how to report 'no known allergies' of various flavors
* [Appointment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\appointment.html#dstu): suitability of Appointment.priority values
* [BodySite](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bodysite.html#dstu): suitability of this as a resource?
* [CarePlan](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\careplan.html#dstu): 2 questions about usage
* [ClinicalImpression](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinicalimpression.html#dstu): general usage questions
* [Composition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\composition.html#dstu): question about title being mandatory, and about signatures
* [Invariants](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#dstu): is there a replaceement for XPath?
* [DataElement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\dataelement.html#dstu): question about relationship between DataElement and other resources
* [Markdown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#dstu): which markdown flavor can we settle on, if any?
* [DiagnosticReport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\diagnosticreport.html#dstu): relationship with Observation
* [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#dstu): question about using the PATCH operation
* [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#dstu-2): what should we do about side-effects and transactions?
* [RESTful API](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#dstu-3): Transaction integrity and introspection
* [Resource Identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html#dstu): identifier policy rules?
* [Messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html#dstu): what additional events should be defined?
* [Operations](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html#dstu): should it be possible to execute operations asynchronously?
* [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#dstu): what effect linking/merging/unlinking should have on other functionality such as the GET operation?
* [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html#dstu-2): Comment on MPI search query sought
* [Profiling](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\profiling.html#dstu): Note about need for feedback about use of profiles
* [References](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#dstu): Should inside out containment be allowed?
* [RiskAssessment](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\riskassessment.html#dstu): General usage questions
* [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#dstu): how much should text search be standardised?
* [Search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html#dstu-2): Should additional rules about how \_include works be made?
* [Security](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security.html#dstu): Using signatures with RESTful interfaces is a poorly understood area
* [Subscription](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\subscription.html): Use with messaging is still to be clarified

# ucum.html

## Using UCUM with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The [Units of Measure](http://unitsofmeasure.org) Coding System (UCUM) is recommended for use with the [Quantity](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Quantity) data type.

### Summary

|  |  |
| --- | --- |
| Source | UCUM is made available by the [Regenstrief Institute, Inc](https://www.regenstrief.org/) and The UCUM Organization at <http://unitsofmeasure.org> |
| System | The URI <http://unitsofmeasure.org> identifies UCUM codes |
| Version | Where a version is used, it should be the standard UCUM version e.g. 1.9. There is no need to use version in the [Coding](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#Coding) data type, only in [Value sets](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\valueset.html) that use UCUM codes |
| Code | Valid expressions using the case sensitive symbols |
| Display | There is no defined display; the UCUM code is used directly for the display |
| Filter Properties | Two filter properties are defined as described below |

### Copyright

UCUM is Copyright Â© 1999-2013 Regenstrief Institute, Inc. and The UCUM Organization, Indianapolis, IN. All rights reserved. See [TermsOfUse](http://unitsofmeasure.org/trac//wiki/TermsOfUse) for details.

### UCUM Filter Properties

This section documents the property filters that can be used with the UCUM code system in value set composition statements.

#### Property filter

|  |  |
| --- | --- |
| Description | Restricts the expression to a describe a particular UCUM base property |
| Property Name | property |
| Operations Allowed | = |
| Values Allowed | [string name of property] |
| Comments | Restricts expressions to any expression that is comparable to a base unit with a matching property value. Note: this does not match the property on units, only base units |

#### Canonical Filter

|  |  |
| --- | --- |
| Description | Allows for any expression that is comparable to the named unit |
| Property Name | canonical |
| Operations Allowed | = / in |
| Values Allowed | UCUM expression |
| Comments | This allows any expression that is comparable to the given unit(s) |

### Implicit Value Sets

Implicit value sets are those whose specification can be predicted based on the grammar of the underlying code system, and the known structure of the URL that refers to them. There is one set of implicit value sets defined for UCUM: By Canonical Value.

If any value set resources exist with an identifier that conforms to the URL patterns specified below, the content of the resource must conform to the template provided. Profiles and other value set references are allowed to reference these value sets directly.

The value set identifier http://unitsofmeasure.org/vs is a value set that contains all LOINC codes.

#### Multi-Axial Hierarchy Entry

A value set with an identifier of "http://unitsofmeasure.org/vs/[expression]" must conform to this template, where [expression] is a valid UCUM expression:

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

[some html that identifies that this value set

includes all UCUM expressions that are comparable to the provided expression]

</div>

</text>

<identifier value="http://unitsofmeasure.org/vs/[expression]"/>

<version value="[optional - but recommended - UCUM version]"/>

<name value="Ucum Expressions comparable to [expression]"/>

<description value="Ucum Expressions comparable to [expression]"/>

<status value="active"/>

<date value="[optional date of LOINC release]"/>

<compose>

<include>

<system value="http://unitsofmeasure.org"/>

<filter>

<property value="comparable"/>

<op value="="/>

<value value="[expression]"/>

</filter>

</include>

</compose>

</ValueSet>

# unii.html

## Using Unique Ingredient Identifier (UNII) with FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

### Summary

|  |  |
| --- | --- |
| Source | [FDA Substance Regsitration System](http://fdasis.nlm.nih.gov) |
| System | The URI to identify UNII codes is http://fdasis.nlm.nih.gov |
| Version | If it is desired to exchange the version, use the date of the file in the UNII list download in the format YYYYMMDD |
| Code | Use the value of the UNII column in the UNII List |
| Display | Use the value of the PT (Preferred Term) column in the UNII List |
| Filter Properties | None are described yet |

### Version Issues

To be investigated

### Copyright/License Issues

UNII has no copyright acknowledgement needed, nor are there any license terms to adhere to.

### NDF-RT Filter Properties

No need for filters identified yet.

### Implicit Value Sets

No need for implicit value sets identified yet.

# updates.html

## Variations between Submitted data and Retrieved data

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Some of the time when using a FHIR interface, requests to create or update resource instances will behave exactly as the initiator requested. The desired record(s) will be created or revised within the target system and a subsequent query of the data would show the exact same information as was submitted. However, FHIR systems are not guaranteed to behave this way. Without any other agreement between exchange partners, FHIR systems are not obligated to store and return data as it was received. In fact, for some interoperability paradigms, they're not obligated to store any data at all. This page discusses some of the considerations around system behavior, including differences in expectations for systems interoperating using REST, messaging, documents and services.

### Data element support

The most common reason for differences between what data is submitted to a system and what data can be extracted from it is that the system doesn't support all of the data elements present in the instance received. In the base resource, no systems are required to support any particular set of extensions or even any particular subset of core elements.

For elements that are part of the resource, the expectation is that "most" systems will support the element. I.e. Most systems will support capturing a patient's name, gender and date of birth. But "most" does not mean "all". It's possible to be fully FHIR conformant and claim to support the Patient resource, but be incapable of storing any of those data elements. There are use-case where names may be unnecessary (e.g. aggricultural veterinary systems, anonymized reporting, etc.) and similar use-cases for almost every data element. No FHIR resource elements start off as [mustSupport](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\elementdefinition-definitions.html#ElementDefinition.mustSupport) and very few resource elements start off with a minimum cardinality other than "0".

In the case of extensions, the very nature of a concept being an extension means that the designers of the specification expected that fewer than "most" systems would support the element, though support might vary widely by context. An extension might be used by 100% of systems in some country, discipline, etc. while be used by absolutely no systems in another context. In any event, there is no guarantee that an arbitrary receiver will recognize and be able to persist any given extension.

In order to know whether a particular data element is likely to be stored by a given server, a client should check the [Conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) of that server. If, for a given resource, the [StructureDefinition](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\structuredefinition.html) pointed to indicates that the element or extension is "mustSupport=true", and the server is capable of storing and returning data in general, then it would be expected that the system will be capable of storing and returning that data element. (Some servers such as decision support system might not be capable of storing or returning any received data.)

All of these concerns around possibly not storing resource elements or extensions can hold whether the data is sent using [REST](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html), [Messaging](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html) or [Services](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\services.html). However, with [documents](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html), a consuming system is expected to accept the entire contents of the document without losing any information or altering it in any way.

### System behavior

Even if a system supports all of the data elements provided, not all systems will actually persist the data received or be capable of returning it in response to a query. *mustSupport* indicates that a system supports an element but does not prescribe exactly what the system must do with supported elements. Data might be persisted, displayed, relayed, analyzed, tabulate or used in a variety of other fashions. The behavior of a given system should be unsurprising given its context, but it's still important to recognize that not all systems will persist the data they receive.

### Access permissions

Even if a system stores a given data element, that doesn't mean it will always include that element when responding to queries. Systems will have access permssion rules that restrict who can see a given resource instance and, occasionally, who can see a particular data element within a resource. Systems responding to queries might suppress records or may adjust the content of resource instances to exclude data elements the querying system is not permitted to see.

### Generated and inferred data

Some servers may add additional data elements (or more commonly, extensions) based on information they have generated or inferred from data in the resource, from other resources or other information of which the server is aware. I.e. An instance queried after being created or updated might have *more* information present than was included on the originally submitted record

### Data integration

Servers receiving updates from multiple sources may choose to be selective about what sources they choose to trust for updates to certain information. For example, a patient registry system might choose to only allow updates to name, gender and date of birth from administrative systems but not clinical systems. If a system filters out patient address information from being disclosed to a system when it queries, it will likely choose to not replace or eliminate the addresses it has on file when it receives an update from that system.

One approach commonly followed by HL7 version 2 messaging interfaces is to not update any elements not included in an instance. For example, if a Patient instance were received with no telecom or contact information, all existing telecom and contact information would be retained and only those elements included in the instance would be updated. This same approach can be followed with FHIR, however, unlike HL7 v2, FHIR does not have a defined construct to use to indicate that a particular data element should explicitly be set to empty. Systems wishing to fully emulate v2 behavior will need to use an extension to mirror this behavior.

### Ramifications of storage/retrieval variations

While changing data prior to storage or prior to returning query results is possible, it should not be considered "normal" behavior. It creates several challenges:

* Digital signatures will no longer be valid. Any change to submitted data will break standard signatures. In theory, this could be mitigated by using a custom canonicalization for the signature that excludes maliable elements. However, this would require both sender and receiver to agree on the alternate signature canonicalization. The signature would still be considered invalid by systems that weren't party to the agreement.
* Workflows can be made more complex. A system that sends a create and then sends an update presuming that it has seen the most "current" version, could accidentally overwrite information set by the server as part of the create process.
* Audit becomes more complicated. The [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resource points to a specific resource version when tracking what data was returned by a query. If the record is modified when it is returned, then the audit record will likely need to be supplemented with information about what elements were filtered.
* Multiple views of the same information by different people (or even by the same people in different contexts) may cause confusion, particularly when attempting to coordinate care across a team. Providing OperationOutcome instances containing warnings if information has been suppressed may be helpful, though doing this may not be possible, depending on security policy rules.
* If data is lost as part of the transmission process, then multiple stages of transmission (or even round-tripping of data) could result in significant degradation as information passes through multiple systems.

### Mitigation approaches for storage/retrieval variations

FHIR does provide a couple of mechanisms that can help with the issue of a system that has received only partial data overwriting data that was filtered from its record::

* For systems that enforce the use of [ETags](http://www.w3.org/Protocols/rfc2616/rfc2616-sec14.html#sec14.19) for updates, the server can choose to not include an ETag when returning resource instances that have been modified in some way. This will prevent updates from being performed.
* The [SUBSETTED](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\v3\vs\SecurityIntegrityObservationValue\index.html#SUBSETTED) [Security Label](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\security-labels.html) can be used to flag data that has had information removed.

Note that using either of the above mechanisms may constitute a security breach in circumstances where the individual or system accessing the data should not know that the record they're reviewing has been modified in any way. (The presence of digital signatures would present a similar issue.)

# use.html

## How to Use Resources

### Service Orientated use of Resources

While the FHIR Resources are designed with a simple [RESTful HTTP-based implementation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html) in mind, it is not necessary to use this implementation framework. This specification also defines a straight [messaging based implementation framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html) for FHIR resources and a [document-based framework](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html).

Alternatively, it is not necessary to use any of these approaches. Resources can be exchanged or persisted using any technical means that is appropriate to the context at hand. A common use of FHIR resources or [bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle) is as parameters of service interfaces. FHIR itself does not define any particular service interface. Instead, other standards and implementations define their own service interfaces and architecture that use FHIR resources and optionally build extra features on top of the base repository-mediated exchange that the FHIR RESTful specification provides. As long as the resources that are used are conformant with this specification and the rules for authoring and reading applications are followed, then the implementation can claim conformance to "FHIR Resources". Such implementations will need to resolve several issues:

* Resource identity (the "id" metadata property) must be maintained. Resources all have an identity, which is how other resources refer to them, and these references need to be able to be resolved. However resources are exchanged, their identity - which is not included inside the resource - needs to be included with the resource
* Resource references need to be resolvable. There are a variety of solutions to this, from ensuring that all the relevant resources are bundled together or that all relevant resources are passed as parameters in a service call, through to having a resource repository in the background that provides access to all referenced resources.
* The [Resource metadata](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#metadata) items "Version Id" and "Last Modified Date" are provided for use in resolving resource versioning and concurrency issues, both from a technical and human perspective. Most contexts of use will require at least one if not both of these attributes for some uses, and the implementation framework will need to resolve how and when they are exchanged.
* The [conformance statement](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance.html) allows authoring and reading applications to describe their rules concerning the use and contents of a resource. The implementation will need to describe how this conformance statement or some other equivalent fits into the exchange/persistence context.
* How transactional information such as data enterer, author(s), responsible party, consent and approvals is treated

The resolution to these issues should be documented and published with the service specification.

### Managing Resource Identity

Each resource has a known identity. The identity is not stored inside the resource, but must be tracked by systems handling resources. For RESTful systems, the resource identity is the same as the URL by which it is found. When a resource is packaged in a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle), the id is included along with the resource. Real-world use of FHIR resources creates the need to manage resource identification.

Resources are used in a variety of circumstances. Generally, these can be categorized into 3 different scenarios:

1. **Closed Trading System**: the resources are only ever exchanged between fixed systems in a tightly controlled community, such as a hospital. There is only one master server for each resource type, and resources are managed by that server. In this context, the logical id of a resource is sufficient to fully identify the resource
2. **World-wide RESTful system**: there are many peer servers, each managing a set of resources of different types. In order to identify resources, a full URL reference to the origin server is required
3. **Partially closed, inter-linked systems**: a mixture of both - trading communities that are tightly managed, but have managed interactions with other closed trading systems, or with the world-wide RESTful system, or both. In fact, this combination appears to be the most likely scenario for current real-world healthcare business solutions

These combinations show why either relative (logical) or absolute references are allowed, and why a logical id is always required, in order to enable seamless exchange amongst partially closed trading systems.

### Copying Resources and re-identification

When resources are exchanged between systems, they may need to be re-identified (i.e. assigned a new resource). When a resource is re-identified, nothing in the resource changes, but any references that point to the resource need to be updated. Whether re-identification is required or not depends on the context, as does how resource references are updated.

The normal case is that a client/receiving system accepts the server/sender's identification of a resource at the face value, whether it is a relative or absolute reference. When the client/receiver wants to follow resource references, they are done using the server id (typically either by http calls or locating them in a [bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\compartments.html#bundle)). In such cases, there is no need for re-identification.

Another scenario is for a client to retrieve a resource from a server, and make its own local persistent copy. If the local resource has a life-cycle of its own (i.e. it is not just a cached resource), then it needs to have its own identity; i.e. the resource must be re-identified. The simplest case is that the client only is keeping local copies of resources from a single server. In these cases, the client can simply replace the root URL and keep the logical id of the resource the same. In fact, if the server is using relative references, then this change doesn't involve any actual changes to the resources, only a re-interpretation of the references.

In some cases, however, the client may deal with multiple servers. In this case, the logical id of the resource is not guaranteed to be unique (unless all resources have a UUID for the logical id, which is allowed but not required). When the client cannot be sure that the resource identities are unique, it will have to re-identify the resources. In practice this means that the client needs to keep an identity translation table, and update references to the resources it has copied locally when other resources are received.

The case of a gateway system that migrates resources from one ecosystem to another is very similar. In some limited cases, it can leave the logical id of the resources unchanged as resources are copied from one closed system to another. However in more complicated cases, it will have to modify the resource references as resources pass across the gateway.

## Workflow with resources

There are many ways to implement any particular workflow and there are many ways to use resources to build working systems:

* A RESTful paradigm where resources are exchanged separately using http transactions directly as defined in this specification. Implementations can use both push and pull or a mix of the two
* The resources can be exchanged in messages or some other SOA implementation where the resources form the contents/parameters that are exchanged
* The resources can be "bundled" into documents that are self-contained and complete collections of linked resources and then these documents can be exchanged and/or persisted
* The resources can be embedded in HTML pages or other web content such as content feeds

# usecases.html

# Common Example Scenarios in FHIR

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

FHIR is a framework standard that defines a common way to solve healthcare problems and provides a set of resources that can be used in many different ways. This page describes how certain common usage scenarios are implemented using the capabilities that FHIR defines. The provided scenarios are examples of usage and are not in any way exhaustive. FHIR can and will be used in a wide variety of circumstances.

In addition, to the information on this page, see also [Resource Guide](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resourceguide.html).

## Personal Health Record (PHR)

In the PHR scenario, an Electronic Medical Record system (EMR, though many other names and acronyms are also used) provides a RESTful API that allows patients to access their own medical record via a common web portal or mobile application, usually provided by a third party. In this scenario, the PHR provider:

* Provides the patient with a login that identifies them (or links the patient record to an external identity provided by OpenID, Facebook, Google, etc.)
* Authenticates the client using an appropriate OAuth server for the login (possibly their own) and restricts the client to viewing records associated with the specific patient (or patients, where appropriate access has been arranged)

The EMR exposes a FHIR server that supports the [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) and [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) operations on the following resources:

1. the [patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html) resource in order to provide demographics to the client. When a client searches patients with no search criteria, they get a list of all patients they have access to
2. [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) and [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) on the [Document Reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) resource to provide access to general patient documents in the form of PDFs etc. (PDFs are preferred)
3. [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search) and [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) on a set of [clinical resources](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\clinical.html)

Here is the conformance Statement for this scenario: [XML](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-phr-example.xml.html) or [JSON](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-phr-example.json.html).

The EMR may also choose to provide additional functionality, such as shared access to patient records by relatives/carers, to allow the patient to upload their own documents, medication statements, observations (e.g. from patient monitoring devices) and/or to allow the patient to make appointments. This additional functionality will involve additional API capabilities to be implemented and exposed. The EMR server may also choose to expose the [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#search), [read](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#read) and [history](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#history) operation on the Audit Event resource for the patient-specific records to allow patient review of record access. Note that all usage of the RESTful API should be logged in AuditEvent resources.

## Document Sharing (XDS)

One common way to integrate healthcare information from a variety of sources is to build a repository of documents around a patient record. Building a repository of documents allows for less stringent alignment around policy, procedures and record-keeping/informatics standards.

The most widely adopted framework for sharing documents within institutions, regions, states or countries is IHE Cross-Enterprise Document Sharing (XDS). XDS allows for a federated system of repositories with a registry to provide coordinated access to the documents.

FHIR provides equivalent functionality to XDS that can be used to implement XDS behind the existing XDS.b interface, to provide a simpler mobile-friendly interface to an existing XDS ecosystem, or to link document sharing into other functionality provided through a FHIR interface.

The following FHIR Resources are involved in the XDS functionality:

* The [DocumentReference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documentreference.html) resource describes a document that is located elsewhere. A document registry is a system that maintains a set of Document References
* The [XDS profile](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\xds.html) provides specific XDS implementation detail for the more general DocumentReference resource
* The [Binary](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\http.html#binary) support can be used to store the actual documents on a FHIR server. A repository is a system that stores the binary document in addition to Document References (or sometimes without)
* [Patient](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\patient.html), [Practitioner](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\practitioner.html) and [Organization](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\organization.html) resources provide support for identifying people and organizations
* The [AuditEvent](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\auditevent.html) resource tracks usage of the document registry and repository

At present, IHE is working with the FHIR project team to use FHIR for Mobile Health Documents (MHD).

## Decision Support

One common use of healthcare information systems is to integrate some form of decision support software into clinical systems. Common uses of clinical decision support are:

* Drug-drug interaction checking, and more generally, prescription safety checks
* Suggesting commonly missed Diagnostic Data interpretations (including delta checking)
* Patient surveillance for early warning of deteriorating patient health (both acute and ambulatory care)
* Identifying candidates for alternative treatment plans for improved efficacy

Note that in addition to clinical decision support, there are also infrastructural uses, such as managing access control.

The various forms of decision support each involve different interaction patterns, so there is no single decision support implementation in the FHIR specification. Generally, the patterns fall into several classes:

1. The decision comes from an engine entirely hidden behind a system interface and has no direct impact on the data exchange
2. The decision support engine uses existing data and generates alarm messages concerning patient state that are visible on the FHIR interface
3. The decision support engine is consulted through a described interface; it accepts a request for a decision and returns a decision

Any decision support may fall into multiple categories at once, depending on the perspective of a particular system.

1. There is no particular support required from the FHIR specification, though there will be ongoing review of the contents of the resources to ensure that they support common decision support practices appropriately
2. There is no suitable resource for this use yet. The [Flag](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\flag.html) resource is intended or clinical notes about the patient, and is not intended for this use. A resource called "Alarm" is under preparation for this purpose
3. A request for a decision support is understood as a [search](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html) using a named \_query that takes a set of parameters. See below

### Explicit Requests for Decisions

When a query is initiated in order to get a decision made, the following considerations apply:

**Request**

* The request for a decision is made using one of the interaction patterns described for [search/query](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\search.html): A RESTful search, a query posted to [/Mailbox](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html#mailbox), a query [message](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\messaging.html), or the Asynchronous query pattern
* The request has a \_query parameter that identifies the decision that is being requested
* The request also has a set of parameter values. These parameter values may be the data that describes the decision being made or they may be references to specific resources that contain the request. In general, the more complex the decision request is, the more likely it is that a full resource is appropriate, particularly since this provides a ready made way to record and manage the requests themselves.
* In some of the query interaction patterns, the resources identified in the parameter value can be bundled up with the request. In others, only the references can be passed
* Which of the query patterns is most appropriate depends on the complexity of the decision support input, and the length of time the decision is expected to take. As either of these increases, the more complex query patterns become more appropriate

**Response**

* If the decision support engine is unable to provide the requested decision, it returns an [Operation Outcome Resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) describing the issue
* Otherwise it returns a resource that represents the decision, along with other resources as supporting information, as described by the resource, or applicable profiles
* In principle, the decision provider can choose to make a copy of the returned decision resource available through a normal RESTful interface, or it can choose not to. This decision may be constrained by applicable profiles, policy decision, or the innate nature of the query
* If either the decision provider or the requester choose to retain a copy of the decision, they must ensure that the (lack of) currency of the decision is appropriately considered when it is used

It follows from this then, that decisions that may be requested need at least a response resource defined, and possibly a request resource. This table summarizes known decisions for which resources have been defined.

|  |  |  |
| --- | --- | --- |
| **Decision** | **Resources** | **Invocation** |
| What immunizations should this patient have? | Response: [ImmunizationRecommendation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\immunizationrecommendation.html) | The exact way to invoke this decision is not yet defined |

Implementers are allowed to use existing resources for decisions not documented here, but there is no guarantee that they will be suitable. Improving decision support will be a focus for ongoing development during the Trial Use period.

# validation.html

## Validating Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

This page provides a quick overview of how the FHIR specification supports validation of resources.

In principle, resources can be validated:

* Against the original specification
* Against an implementation guide
* Against a specific profile

Resources can be tested for conformance by:

* [Using the XML Schema](#schema) - for XML instances only
* [Using the FHIR Validator](#jar) - a java jar provided as part of the specification
* [Asking a FHIR Server](#op) - using the $validate operation
* [Via a web interface](#web) - using a web form on a test server

Note that all these validation methods are incomplete; they can only validate the computable aspects of conformance, but there are always additional rules made in narrative that they are not able to check (e.g. a rule such as "All the clinically important content in the data SHALL be in the narrative", which might be made in an implementation guide, but could never be checked by a conformance tool).

In case of disagreement between these conformance methods, note that:

* The schema/schematron is the least capable - mainly because it is not connected to a terminology server
* The java validator is only as good as the underlying definitions, and in particular depends on whether the underlying terminology server supports all the relevant terminologies
* In general, the server validation operations use or derive from the java validation code, so have the same caveats
* The final arbiter is human inspection of the content of the resources, and the relevant implementation guides and base specification

Also, note that static testing of resource content is not enough to prove conformance to the specification. For further information, see [FHIR Conformance Testing](http://fhir.org/conformance-testing).

### Using the XML schema

The XML schema can be used to validate XML represenations of the resources. When validating a resource, you can nominate one of the following schema:

* fhir-all.xsd: links in all the individual modular schemas
* fhir-single.xsd: a single large file, mainly provided for schema processors that can't support circular references

In addition, the validation schema includes schematron that can be initiated with transform "iso\_svrl\_for\_xslt2.xsl" included in the [XML Tools](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html#refimpl) download. Note that XSLT2 is required to run the schematrons.

When running the schematron, use the file "fhir-invariants.sch". This includes all the schematrons. The individual schematron files for each resource are provided to allow implementers to build their own smaller combined file that covers the relevant resource types for them.

### Using the FHIR Validator

The FHIR Validator is a Java jar that is provided as part of the specification, and that is used during the publication process to validate that all the published examples. To execute the FHIR validator, follow the following steps:

* [Download](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html) the FHIR Validator
* [Download](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\downloads.html) One of the FHIR definitions (with or without text)
* Execute the validator, providing the path to the definitions, and a reference to the resource to validate

Here is an example windows batch file that demonstrates the process (using the common utilities [wget](http://gnuwin32.sourceforge.net/packages/wget.htm) and [7z](http://www.7-zip.org/):

@ECHO OFF

ECHO get the validator and unzip it

wget.exe http://hl7.org/fhir/validator.zip

7z.exe x validator.zip

ECHO Get the validation source file (dictionary)

wget.exe http://hl7.org/fhir/validation-min.xml.zip

ECHO get an example to validate

wget.exe http://hl7.org/fhir/patient-example.html -O test-obs.xml

ECHO validate it. The DAF profile will be loaded out of the definitions in validation-min.zip

java -jar org.hl7.fhir.validator.jar test-obs.xml -defn validation-min.xml.zip -profile http://hl7.org/fhir/StructureDefinition/daf-patient

pause

Note that it is not necessary to download the resource first; the http address can be supplied directly:

java -jar org.hl7.fhir.validator.jar http://hl7.org/fhir/patient-example.html -defn validation-min.xml.zip -profile http://hl7.org/fhir/StructureDefinition/daf-patient

The validator requires an underlying terminology server. TODO: document this part. for now, hard coded to http://fhir-dev.healthintersections.com.au.

### Asking a FHIR Server

The [operation](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operations.html) [validate](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource-operations.html#validate) can be used to check whether a resource conforms to a profile. The simplest way to execute this operation is to post the resource to a server:

POST [base]/Patient/$validate?profile=http://hl7.org/fhir/StructureDefinition/daf-patient

[other HTTP headers]

<Patient>.. resource to check as the body

The server will return an [OperationOutcome](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\operationoutcome.html) resource listing issues found in the resource.

There are several things to consider when using this operation:

* Not all servers support the $validate operation, though some of the public test servers do
* Servers support the $validate operation generally will only validate against profiles already registered with the server
* Servers may choose to support either XML, JSON, or both

### Via a web interface

Some servers expose the $validate functionality though a web page. for known public implementations, see the [FHIR wiki](http://wiki.hl7.org/index.php?title=Public_FHIR_Validation_Services)

# w5.html

# FHIR W5 Report

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): N/A | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

Concise

Full

# xml.html

## XML Representation of Resources

|  |  |  |
| --- | --- | --- |
| Work Group | [Maturity Level](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html#maturity): 4 | [Ballot Status](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\help.html#status): [DSTU 2](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\history.html#pubs) |

The XML representation for a resource is described using this format:

<**name** xmlns="http://hl7.org/fhir" (attrA="value")>

<**nameA**><!--  **1..1** type description of content --><nameA>

<**nameB[x]**><!-- 0..1 type1|type1 description --></nameB>

<**nameC**> <!-- **1..\*** -->

<**nameD**><!-- 1..1 type>Relevant elements --></nameD>

</nameC>

<name>

Using this format:

* To build a valid XML instance of a resource, simply replace the contents of the elements and attributes with valid content as described by the cardinality, type rules and content description found in the comment in each element
* Resource and Element names are case-sensitive (though duplicates that differ only in case are never defined)
* Elements must always appear in the order documented
* When an element is allowed to repeat, the elements are ordered, and implementations must preserve order (note: the meaning of the order may not be known)
* A few properties are represented as attributes: primitive values in the "value" attribute, extension URLs in the "url" attribute on an extension, and the "id" property
* Any of the XML elements may have an id attribute to serve as [the target of an internal reference](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\references.html#id). The id attribute is not shown in this format
* FHIR elements are always in the namespace <http://hl7.org/fhir>. This is usually specified as the default namespace on the root element. The only other namespace that occurs in FHIR resources is the XHTML namespace ([XHTML is found in most resources)](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* Infrastructural elements that are common to all resources are not shown in the xml representation. These must appear prior to any other defined child elements in the following order:
  + First, the elements from the [base resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\resource.html), in order
  + Second, the elements from the [domain resource](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\domainresource.html), in order
* FHIR elements are never empty. If an element is present in the resource, it SHALL have either a value attribute, child elements as defined for its type, or 1 or more [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html)
* Attributes can never be empty. Either they are absent, or they are present with at least one character of non-whitespace content
* Implementers SHOULD trim leading and trailing whitespace before writing and SHOULD trim leading and trailing whitespace when reading attribute values
* The lock icon () denotes that an element defines or is affected by [additional rules](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-rules.html#constraints) that control its presence and/or content
* XML comments, processing instructions and formatting are not part of the contents of a resource
* XML resources SHALL be exchanged using UTF-8 encoding. Specifying the character encoding using a <?xml encoding="UTF-8" ?> processing instruction is optional but recommended
* Other processing instructions SHOULD not be included, and SHALL NOT be required in order to properly understand and/or present the data or narrative of the resource. Applications MAY preserve processing instructions when handling resources, but are not required to do so
* The MIME-type for this format is application/xml+fhir.

### XML Schema and Schematron

This specification provides schema definitions for all of the content models it describes.

The base schema is called "[fhir-base.xsd](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-base.xsd)" and defines all of the datatypes and base infrastructure types. In addition, there is a schema for each resource and a common schema [fhir-all.xsd](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-all.xsd) that includes all the resource schemas. For schema processors that do not like circular includes, there is [a single schema](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\fhir-single.xsd) that contains everything.

In addition to the w3c schema files, this specification also provides Schematron files that enforce the various constraints defined for the datatypes and resources. These are packaged as files for each resource.

XML that is exchanged SHALL be valid against the w3c schema and Schematron, though being valid against the schema and Schematron is not sufficient to be a conformant instance: this specification makes several rules that cannot be checked by either mechanism. Operational systems may choose to use schema tools to check validation, but are not required to do so. Exchanged content SHALL NOT specify the schema or even contain the schema instance namespace in the resource itself.

Given the way [extensions](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\extensibility.html) work, applications reading XML resources will never enocunter unknown elements. However once an application starts trading with other appplications that conform to later versions of this specification, unknown XML elements may be encountered. Applications MAY choose to ignore unknown elements in order to foster forwards compatibility in this regard, but may also choose not to - which would be the normal behaviour for schema generated applications. Applications declare their behaviour with regard to unknown elements using [Conformance.acceptUnknown](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\conformance-definitions.html#Conformance.acceptUnknown).

### Code Generation Schema

In addition to the validation schema, this specification provides a set of schema suitable for code generation usage. These schema describe the same XML syntax, but apply less validation in order to create a schema that works with more code generation frameworks.

Specifically, these schemas are generated without any xs:choice elements, for code generators that don't deal with choices well. Implementers that use these schemas will need to enforce the correct usage of the [choice elements](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\formats.html#choice) without schema support.

Implementers making use of schema driven code generation tooling need to consider how to handle the [decimal](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\datatypes.html#decimal) data type. The decimal data type is defined to be precision aware - that is, that implementers need to preserve the difference between "2.0" and "2.00" - this is ubiquitiously considered important in handling observed data in healthcare. Both schemas map this data type to xsd:decimal, but the base [W3C schema decimal type](http://www.w3.org/TR/xmlschema-2/#decimal) is specified not to be precision aware. Schema driven implementations vary as to how precision is handled, and implementers will need to determine how their generated code handles decimals, and consider changing the type for decimal in the schema from xsd:decimal to xsd:string. Specifically, implementers may wish to change

<xs:simpleType name="decimal-primitive">

<xs:restriction base="xs:decimal">

<xs:pattern value="-?([0]|([1-9][0-9]\*))(\.[0-9]+)?"/>

</xs:restriction>

</xs:simpleType>

to this:

<xs:simpleType name="decimal-primitive">

<xs:restriction base="xs:string">

<xs:pattern value="-?([0]|([1-9][0-9]\*))(\.[0-9]+)?"/>

</xs:restriction>

</xs:simpleType>

Alternatively, if supported, implementers may wish to use the [precisionDecimal](http://www.w3.org/TR/xsd-precisionDecimal/) from the XSD 1.1 framework.

Note that most code generation frameworks ignore the pattern restriction.

### Canonical XML

Resources and/or Bundles may be digitally signed (see [Bundle](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\bundle.html) and [Provenance](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\provenance.html)).

This specification defines the following method for canonicalizing FHIR resources, when represented as xml:

* No whitespace other than single spaces in attribute values and in the xhtml in the [Narrative](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\narrative.html)
* Use default namespaces for the FHIR and XHTML namespaces
* Omit all elements that have a default value, if a default value is defined
* Omit all comments
* Always use the unicode character representation for any XML entities (e.g. &#39; instead of &quot;)
* Include the XML processing instruction <?xml version="1.0" encoding="UTF-8"?>
* Using the XML canonical method [Canonical XML 1.1](http://www.w3.org/TR/xmldsig-core1/#sec-Canonical) (http://www.w3.org/2006/12/xml-c14n11)

This canonicalization method is identified by the URL http://hl7.org/fhir/canonicalization/xml. The following additional canonicalization URLS are also defined:

|  |  |
| --- | --- |
| http://hl7.org/fhir/canonicalization/xml#data | The narrative (Resource.text) is omitted prior to signing (note the deletion is at Resource.text, not Resource.text.div) |
| http://hl7.org/fhir/canonicalization/xml#static | In addition to narrative (Resource.text), the Resource.meta element is removed. This makes the signature robust as the content is moved from server to server, or workflow and access tags are added or removed |
| http://hl7.org/fhir/canonicalization/xml#narrative | The method only covers the Resource.id and Narrative is retained |

These canonicalization methods allow system the flexiibility to sign the various portions of the resource that matter for the workflow the signature serves.

Note: One consequence of signing the document is that URLs, identifiers and internal references are frozen and cannot be changed. This might be a desired feature, but it may also cripple interoperability between closed ecosystems where [re-identification](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\managing.html) frequently occurs. For this reason, it is recommended that systems consider carefully the impact of any signature processes. The impact of signatures on [Document bundles](file:///C:\Users\Lloyd\Documents\SVN\FHIR\build\qa\documents.html) and their related processes is the most well understood use of digital signatures.