**C:\Users\lloyd\Documents\SVN\FHIR\build\source\detectedissue\detectedissue-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\detectedissue\detectedissue-introduction.xml**

**Scope and Usage**

**This resource is an *event* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Event](file:///C:\temp\workflow.html#event).

This resource applies to various circumstances where there is a concern about an existing or proposed set of clinical activity. The issue could relate to single, proposed, or multiple actions. It does not apply to technical issues (e.g. lack of user permissions) but could relate to violation of patient consent limitations. Examples include:

* Drug-drug interactions
* Inappropriate therapy (wrong dose, frequency, body site)
* Duplicate therapy

This resource represents a specific instance of a potential issue for a particular patient. It is **not** intended to represent general patient-independent knowledge. This resource is also **not** intended to be used in defining general prohibitions on actions such as "No NSAIDs", "No solid oral dose forms" or "No MRIs - metalic tatoos". These guidelines can be captured using the [AllergyIntolerance](file:///C:\temp\allergyintolerance.html), and/or [Flag](file:///C:\temp\flag.html) resources. Similarly this resource is not to be used to capture clinical facts that may imply contraindications such as pregnancy, breast feeding, patient preferences, past procedures, etc. These would be represented using [Condition](file:///C:\temp\condition.html), [Procedure](file:///C:\temp\procedure.html) or other resources.

**Boundaries and Relationships**

This resource only applies to documenting a risk associated with a specific planned or ongoing action, not a general propensity to risk. The latter would be handled using [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) for substance-specific issues or [Flag](file:///C:\temp\flag.html) for other types of issues.

This resource is limited to clinical issues associated with a proposed or ongoing action. It does not cover technical issues such as lack of permission, duplicate identifiers and other business rule violations. Technical issues are conveyed using the [OperationOutcome](file:///C:\temp\operationoutcome.html) resource. It is possible to have both [OperationOutcome](file:///C:\temp\operationoutcome.html) and DetectedIssue together, where the OperationOutcome might indicate that a requested action was rejected due to a clinical issue and the DetectedIssue provides the details of the issue.

**Background and Context**

Detected issues are typically identified by decision support systems. However, they may also be captured directly by clinicians. The latter typically happens for one of two reasons:

1. A clinician wishes to communicate an issue to another clinician whose responsibility would be to resolve it (e.g. a pharmacist identifying an issue with a prescription prior to putting it on hold)
2. A clinician wishes to pre-emptively identify that an issue is known and is being managed (to avoid red flags being raised as part of downstream workflow); e.g. Submitting a new order and including a link to a "duplicate therapy" issue with mitigation indicating that the therapy is not considered to be duplicate.

Decision-support generated issues can result from calling a decision-support engine directly (e.g. via a custom [OperationDefinition](file:///C:\temp\operationdefinition.html)) or as part of an attempt to perform some other function (creating an order, submitting an insurance claim, capturing a medication list). When the issues are generated as a byproduct of performing some other sort of action, they may be included in the "response" to the requested action in the same manner as an [OperationOutcome](file:///C:\temp\operationoutcome.html). In fact, both may be present - the [OperationOutcome](file:///C:\temp\operationoutcome.html) indicating that there was a warning or error associated with the request and a **DetectedIssue** providing the clinical details. (The [OperationOutcome](file:///C:\temp\operationoutcome.html) could point to the **DetectedIssue** via an extension.)

In those circumstances where requested operations are rejected as a result of a detected issue, the workflow may support allowing the operation to be re-tried, provided that the identified issue is included as part of the submission (possibly also including a mitigation). In doing so, the sender acknowledges the issue and takes responsibility for it, thus allowing the requested operation to proceed. See [Linking to Detected Issues](file:///C:\temp\intros%20and%20notes.html#linking) for guidance on how a **DetectedIssue** instance might be included as part of another operation.

Systems that require such workflows should document expected behavior as part of their [CapabilityStatement](file:///C:\temp\capabilitystatement.html) declarations.

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**Linking to Detected Issues**

DetectedIssue follows the pattern of linking from the resource created "second". As DetectedIssue originates in response to one or more other existing records, it points to those records rather than being pointed to from them.

In some cases, a detected issue might be associated with a single record. When this occurs, it may be stored as a contained resource within the implicated resource provided that there is no expected need to search for the detected issue directly. However, with detected issues that implicate multiple records, containment is more problematic. In some workflows, a detected issue might be deemed to be "owned" by the record whose creation triggers the contraindication being created - i.e. the "second" or "last" record. However, where multiple actions are proposed as part of a single submission, there can be no single owner and containment will not be feasible.

If there is a strong need to point from an implicated resource to DetectedIssue and containment is not appropriate, an extension can be used.

**Workflow Challenges**

DetectedIssue is a resource that is frequently associated with workflow challenges where frequent alerts that are not clinically relevant result in clinicians tuning out (or turning off) the content and thus missing relevant alerts. Give consideration to this issue before making heavy use of this resource.

**Open Issues**

* Are author, reference and/or mitigation (and its various parts) all part of the 80%?

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\guidanceresponse\guidanceresponse-examples-header.xml**

This example illustrates the use of the GuidanceResponse resource to represent the response returned by an $evaluate operation against the Guideline Appropriate Ordering decision support service module.

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**Scope and Usage**

The GuidanceResponse resource is used to represent the result of invoking a decision support service. It provides a container for the status of the response, any warnings or messages returned by the service, as well as the output data of the module and any suggested actions to be performed.

For a detailed discussion of the evaluation process, refer to the [Guidance Request](file:///C:\temp\cqif\cqif-cds-on-fhir.html#guidance-request) topic in the Clinical Reasoning module.

*Note to implementers: The user-facing external clinical decision support use case supported by the ServiceDefinition/$evaluate operation of the Clinical Reasoning module has significant overlap with the functionality provided by the*[*CDS Hooks*](http://cds-hooks.org)*specification. As part of FHIR STU4, it is the intention to unify the CDS Hooks specification with the Clinical Reasoning module, ensuring that implementers have a single consistent mechanism to support this use case that meets the requirements of both the Clinical Quality Framework and CDS Hooks communities. Although the functionality in both specifications is conceptually aligned, this unification will likely result in changes to both specifications. The CQF and CDS Hooks project teams are committed to this unification and will work to ensure that the resulting changes have as little impact as possible on current and ongoing implementation efforts, while meeting the needs of both communities. The project team is planning on a workable implementation tested at the connectathon in May of 2017, with a trial ballot following in September 2017, targeting publication as part of the STU4 FHIR specification.*

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**GuidanceResponse Search**

Although the GuidanceResponse resource does define search parameters, it is up to the individual decision support service whether or not historical records of guidance requests are preserved. A service may not support searching on GuidanceResponses at all, or it may support searching only for a pre-defined expiration period. The search parameters are defined to provide consumers with a consistent interface to searching if it is available for a specific service implementation. In any case, services should detail the support they do provide using a CapabilityStatement.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\library\library-examples-header.xml**

These examples illustrate the use of the Library resource to share quality measurement and improvement logic as a FHIR resource. Note that the actual content of each library (the Clinical Quality Language (CQL) source, or the XML for the information model definition, etc.) should be contained in the content element as an Attachment. For illustration purposes, the content of each library is included in its raw form, and linked here.

| **Example** | **Description** | **Content** |
| --- | --- | --- |
| Chlamydia Screening Common Library | Common Chlamydia Screening library developed as the running example in the Author's Guide of the Clinical Quality Language specification. | [CQL Source](file:///C:\temp\library-example-content.cql) |
| Exclusive Breastfeeding Intervention Logic | Clinical Decision Support rules derived from CMS9v4 - Exclusive Breastfeeding measure | [CQL Source](file:///C:\temp\library-exclusive-breastfeeding-cds-logic-content.cql) |
| Exclusive Breastfeeding Measure Logic | Quality Measurement logic used to express the CMS9v4 measure. | [CQL Source](file:///C:\temp\library-exclusive-breastfeeding-cqm-logic-content.cql) |
| CMS 146 Measure Logic | Measure logic for CMS 146 used as the running example for Quality Reporting guidance in the Clinical Reasoning module. | [CQL Source](file:///C:\temp\library-cms146-example-content.cql) |
| QUICK Model Definition | The QUICK model information file used by the CQL-to-ELM translator to validate CQL written against the QUICK data model. | [XML Information Model](file:///C:\temp\library-quick-model-definition-content.xml) |
| FHIR Model Definition | The FHIR model information file used by the CQL-to-ELM translator to validate CQL written against the FHIR data model. | [XML Information Model](file:///C:\temp\library-fhir-model-definition-content.xml) |

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**Scope and Usage**

The Library resource is a general purpose container for clinical knowledge assets. These assets may be defined using a non-FHIR representation, such as a shareable library of clinical logic, written in Clinical Quality Language (CQL), or the XML Schema for an information model, or they may be defined using FHIR resources such as the description of a protocol represented by a PlanDefinition resource. In addition to representing the metadata of the library, the resource has elements for tracking dependencies, as well as for representing the parameters and data requirements for any expression functionality provided by the library.

For non-FHIR assets, the actual content of the library is represented using the Attachment data type, and may either be referenced with a url, or the content may be embedded as a base-64 encoded string. Either way, the contentType element of the attachment is used to indicate the representation of the library content.

Note that because the library content may be embedded as well as be retrievable from an external repository via the attachment URL, the possibility exists for the embedded content to be different from the content on the repository. With proper versioning and governance, this should never occur, but to minimize the potential impact of this possibility, implementers SHALL give precedence to the embedded content of a library when it is present.

**Boundaries and Relationships**

The Library resource is definitional in nature, meaning it is intended to represent shareable knowledge independent of any particular patient. This is in contrast to the [DocumentReference](file:///C:\temp\documentreference.html) resource, which captures non-FHIR content related to a specific patient, and the [Media](file:///C:\temp\media.html) and [Binary](file:///C:\temp\binary.html) resources which capture multimedia content and raw binary content, respectively.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\library\library-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\plandefinition\plandefinition-examples-header.xml**

This example illustrates the use of the PlanDefinition resource to represent a Suicide Risk Assessment order set.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\plandefinition\plandefinition-introduction.xml**

**Scope and Usage**

**This resource is a *definition* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Definition](file:///C:\temp\workflow.html#definition).

A plan definition is a pre-defined group of actions to be taken in particular circumstances, often including conditional elements, options, and other decision points. The resource is flexible enough to be used to represent a variety of workflows, as well as clinical decision support and quality improvement assets, including order sets, protocols, and decision support rules.

PlanDefinitions can contain hierarchical groups of action definitions, where each specific action definition describes an activity to be performed (in terms of an [ActivityDefinition](file:///C:\temp\activitydefinition.html) resource), and each group defines additional behavior, relationships, and applicable conditions between the actions in the overall definition.

In addition to describing what should take place, each action in a plan definition can specify *when* and *whether* the action should take place. For when the action should be taken, the triggerDefinition element specifies the action should be taken in response to some trigger occurring (such as a particular point in a workflow being reached, or as the result of a prescription being ordered). For whether the action should be taken, the condition element can be used to provide an expression that evaluates to true or false to indicate the applicability of the action to the specific context.

The process of applying a PlanDefinition to a particular context typically produces request resources representing the actions that should be performed, typically grouped within a [CarePlan](file:///C:\temp\careplan.html) and/or [RequestGroup](file:///C:\temp\requestgroup.html) to capture relationships between the resulting request resources.

Each ActivityDefinition is used to construct a specific resource, based on the definition of the activity and combined with contextual information for the particular patient that the plan definition is being applied to.

As with the ActivityDefinition, a PlanDefinition may provide information about how to transform the activity to a specific intent resource, either by specifying a [StructureMap](file:///C:\temp\structuremap.html) that can be used to perform the transformation completely, or by specifying values for specific elements of the resulting resource using dynamicValue elements in the action.

Note that these mechanisms are provided on both the ActivityDefinition and the PlanDefinition to allow both reusable transformation descriptions, as well as customization of those descriptions within specific contexts. As such, the transform descriptions specified on the PlanDefinition *override* transform descriptions defined on the ActivityDefinition.

Dynamic values within the definitions can be provided by specifying the expression directly, or by referencing an expression defined within a library. For more information on how to reference expressions within resources, refer to the [Using Expressions](file:///C:\temp\cqif\cqif-topics-using-expressions.html) topic.

As an example, the Low Suicide Risk example order set from the Clinical Decision Support Knowledge Artifact Specification can be represented using the PlanDefinition and ActivityDefinition structures: [Low Suicide Risk Example Order Set](file:///C:\temp\plandefinition-example.html).

In addition to the representation of PlanDefinitions, the [$apply](file:///C:\temp\plandefinition-operations.html#apply) operation allows PlanDefinitions to be realized for a specific context such as a patient, practitioner, or institution. For Order Sets specifically, this operation is expected to place the orders defined by the order set, consistent with the service functional requirements defined by the [Order Set specification](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=287).

**Boundaries and Relationships**

The PlanDefinition resource is used to describe series, sequences, or groups of actions to be taken, while the [ActivityDefinition](file:///C:\temp\activitydefinition.html) resource is used to define each specific step or activity to be performed.

As the name implies, the PlanDefinition resource is strictly definitional. It does not represent the intention to take any action, nor does it represent that any actions have been taken. Rather, the resource provides a definition that can be applied in the appropriate circumstances. When the plan definition is applied, the result will in general be a set of actions that should be (or potentially even have been) performed.

Note that the PlanDefinition still has action-level information, as well as a reference to an [ActivityDefinition](file:///C:\temp\activitydefinition.html). The action-level information defined in the PlanDefinition itself is used to describe how the actions are related to each other within the plan, where the ActivityDefinition contains only information about the activity itself.

The following diagram illustrates the relationship between the PlanDefinition and ActivityDefinition resources, as well as a typical realization to CarePlan, RequestGroup, and Request resources:

*Note to implementers: There is some overlap between the content that can be specified in PlanDefinition.actionDefinition and the ActivityDefinition resource. Part of the work for STU4 will be to resolve the overlap and this will likely result in some minor changes to the structures.*

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\plandefinition\plandefinition-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\requestgroup\requestgroup-examples-header.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\requestgroup\requestgroup-introduction.xml**

**Scope and Usage**

**This resource is a *request* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Request](file:///C:\temp\workflow.html#request).

The RequestGroup resource is used to represent a group of optional activities that may be performed for a specific patient or context. This resource is often, but not always, the result of applying a specific [PlanDefinition](file:///C:\temp\plandefinition.html) to a particular patient. Other than differences that tie the RequestGroup to a particular subject and setting, the actionDefinition element of PlanDefinition is identical to the action element of the RequestGroup, allowing the same features and functionality to be used in both places to describe optionality of and relationships between activities in a workflow.

RequestGroups can contain hierarchical groups of actions, where each specific action references the action to be performed (in terms of a [Request](file:///C:\temp\workflow.html#request) resource), and each group describes additional behavior, relationships, and applicable conditions between the actions in the overall group.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\requestgroup\requestgroup-notes.xml**

**Usage**

The RequestGroup resource is used when there are temporal, co-occurrence or other dependencies between one or more steps of an overall workflow. For example, "do procedure A or procedure B, but not both" or "do procedure A after procedure B" or "Act on this ProcedureRequest, then use the value of that observation in the calculation of the dose of this subsequent MedicationRequest". RequestGroups that define actions (i.e. that are more than just narrative representations) will always reference other Request resources with an intent of "option".

Each "option" request can only be interpreted in the context of a RequestGroup that references it. This is because the RequestGroup defines the context in which the option request may/should/must occur, including any triggers, timing constraints, choices, sequencing requirements, etc. Typically such "option" requests will be [contained](file:///C:\temp\references.html#contained) resources due to this dependency. However, in some cases "option" requests may be stand-alone if they are immutable or tightly tied to a [ActivityDefinition](file:///C:\temp\activitydefinition.html) such that the option resources can safely be referenced without a risk of their content/intent changing

Elements in the "option" requests may include extensions for timing or other elements that allow calculation based on information found in the RequestGroup or other referenced "option" resources, as well as to expose elements within the "option" resource for referencing in other "option" resources. These extensions are:

* TODO

The RequestGroup and all of its referenced "option" Requests are treated as a single integrated Request whose status is the status of the RequestGroup. If there is a need to manage statuses of the different parts, separately, refer to the guidance [here](file:///C:\temp\request.html#requestgroup).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\riskassessment\riskassessment-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\riskassessment\riskassessment-introduction.xml**

**Scope and Usage**

**This resource is an *event* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Event](file:///C:\temp\workflow.html#event).

This resource captures predicted outcomes for a patient or population on the basis of source information. Examples include:

* A prognosis statement for a particular condition
* Risk of health outcome (heart attack, particular type of cancer) on the basis of lifestyle factors and/or family history
* List of potential health risks based on a patient's genetic analysis
* A prediction of outbreak infection rates within a geography based on immunization rates

This resource can be used to represent the results of formal scoring/decision support tools that evaluate risk. It can also be used to capture a practitioner's subjective assessment of the patient's risk based on existing knowledge and previous experience.

**Boundaries and Relationships**

Risk assessments are a specialized type of observation. We use a specialized resource to provide a simpler mechanism to capture of a series of risks and to associate those risks with time-ranges, probabilities, etc. All risk assertions are captured at one time based on a single set of source inputs. Capture of a single risk MAY be done using the [Observation](file:///C:\temp\observation.html) class, particularly in circumstances where it's treated as a generic observation, but for consistency, all risk assessments and prognosis SHOULD be captured using **RiskAssessment**.

Risk assessments may be based on a variety of factors, including:

* Basic demographic information from the [Patient](file:///C:\temp\patient.html) or [Group](file:///C:\temp\group.html) resources
* Various [Observations](file:///C:\temp\observation.html) including vital signs, lab information, assessments, genetic information, etc.
* [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html)
* Current, past and proposed therapies [Immunization](file:///C:\temp\immunization.html), [Procedure](file:///C:\temp\procedure.html), [CarePlan](file:///C:\temp\careplan.html), etc.

Because so many resources can potentially be used, no limit is placed on what resources can be sent in RiskAssessment.basis. However, some resources would be nonsensical for this use (e.g. [MessageHeader](file:///C:\temp\messageheader.html)).

**AllergyIntolerance and RiskAssessment**

AllergyIntolerance describes a specific type of risk - propensity to reaction to a substance while [RiskAssessment](file:///C:\temp\riskassessment.html) describes general risks to a subject, not generally based on a reaction.

**Background and Context**

Risk Assessments can be determined manually by health-care providers based on their professional expertise, by using an algorithmic scoring system or through a combination. Risk assessments can also be computed by decision support systems. [OperationDefinitions](file:///C:\temp\operationdefinition.html) may be defined by servers to generate risk assessments based on particular combinations of source resources or other inputs.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\servicedefinition\servicedefinition-examples-header.xml**

This example illustrates the use of the DecisionSupportServiceModule resource to describe a Guideline Appropriate Ordering assessment module. This module is also the focus of the $evaluate operation example.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\servicedefinition\servicedefinition-introduction.xml**

**Scope and Usage**

**This resource is a *definition* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Definition](file:///C:\temp\workflow.html#definition).

The ServiceDefinition defines a module of clinical decision support functionality made available by a decision support service. For example, a service may provide immunization modules, drug-drug interaction checking, or appropriate use assessment.

Each module defines three main features related to its functionality:

* Input and output parameters
* Data requirements
* Triggers

Input and output parameters are used to specify any named parameters used by the module. These are typically patient-independent configuration parameters such as an A1C threshold for a diabetes control module, but they may also be used to return calculations performed by the module.

Data requirements are used to specify the set of data that must be provided (or available) to the module in order to achieve a successful evaluation. For example, if the module requires A1C lab results within the last 6 months, or information on bilateral or both left and right amputation at or below the knee.

Triggers are used to advertise when the module should be invoked. On encountering a specific trigger, a clinical application can invoke the modules associated with the trigger using the [$evaluate](file:///C:\temp\servicedefinition-operations.html#evaluate) operation. Any data required by the module can be sent as part of the request, and any suggested *actions* and other output data are returned via the [GuidanceResponse](file:///C:\temp\guidanceresponse.html) resource.

For a more detailed discussion of the evaluation process, refer to the [Clinical Decision Support](file:///C:\temp\cqif\cqif-cds-on-fhir.html) topic in the Clinical Reasoning module.

*Note to implementers: The user-facing external clinical decision support use case supported by the ServiceDefinition/$evaluate operation of the Clinical Reasoning module has significant overlap with the functionality provided by the*[*CDS Hooks*](http://cds-hooks.org)*specification. As part of FHIR STU4, it is the intention to unify the CDS Hooks specification with the Clinical Reasoning module, ensuring that implementers have a single consistent mechanism to support this use case that meets the requirements of both the Clinical Quality Framework and CDS Hooks communities. Although the functionality in both specifications is conceptually aligned, this unification will likely result in changes to both specifications. The CQF and CDS Hooks project teams are committed to this unification and will work to ensure that the resulting changes have as little impact as possible on current and ongoing implementation efforts, while meeting the needs of both communities. The project team is planning on a workable implementation tested at the connectathon in May of 2017, with a trial ballot following in September 2017, targeting publication as part of the STU4 FHIR specification.*

**Boundaries and Relationships**

The ServiceDefinition is similar in structure and purpose to [OperationDefinition](file:///C:\temp\operationdefinition.html). However, ServiceDefinition also represents more information about *what* service is being described than an operation definition supports. This information is critical to the effective use of the resource as part of a decision support service repository, as it enables searching and selection of functionality based on this additional information.

In addition, the way the $evaluate operation of the ServiceDefinition resource is defined enables all decision support services to share a common set of parameters without having to redeclare them for every module, while still supporting service-specific paramters on each module.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-consensus-seq-block-introduction.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-consensus-sequence-block-introduction.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-genetics-variant-introduction.xml**

**Overview**

The sequence-genetics-variant profile (i.e. Profile for variant) extends the [Sequence](file:///C:\temp\Sequence.html) resource to enable reporting one result of structured genetic test. In addition, the variant profile contextualizes well established standards from the field of clinical genetics into the standards of healthcare (e.g. HGNC - HUGO Gene Nomenclature Committee's international standard for gene names, symbols, and identifiers).

**Genetic Standards and Resources include:**

* Variant Databases: [dbSNP](http://www.ncbi.nlm.nih.gov/projects/SNP/snp_ref.cgi) , [ClinVar](http://www.ncbi.nlm.nih.gov/clinvar/), and [COSMIC](http://cancer.sanger.ac.uk/cosmic/)
* Reference Sequences: [RefSeq](http://www.ncbi.nlm.nih.gov/refseq/) and [ENSEMBL](http://www.ensembl.org/index.html)
* Gene Symbols and Identifiers: [HGNC](http://www.genenames.org) - Human Genee Nomenclature Committee
* Variant Nomenclature: [HGVS](http://www.hgvs.org) nomenclature from the Human Genome Variantion Society
* Variant Feature Annotation: [Sequence Ontology (SO)](http://www.sequenceontology.org) and [LOINC](https://loinc.org)
* Locus: [Gene](http://www.ncbi.nlm.nih.gov/gene)

**Scope and Usage**

The sequence-genetics-variant profile supports reporting of a DNA variant at the genomic, cDNA, and protein change level. It is strongly encouraged to provide all available information in this profile for any reported variants, because receiving systems (e.g. discovery research, outcomes analysis, and public health reporting) may use this information to normalize variants over time or across sources. However, these data should not be used to dynamically correct/change variant representations for clinical use outside of the laboratory, due to insufficient information.

Implementers should be aware that semantic equivalency of results of genetic variants cannot be guaranteed unless there is an agreed upon standard between sending and receiving systems.

These challenges raised above are discussed in the HL7 Clinical Sequencing Domain Analysis Model (passed January 2015 ballot and in process of being published).

Hl7 Clinical Genomics Work Group emphasizes the importance of transmitting structured genetic findings within the clinical, translational, and research environments fully integrated with other clinical data, in order to drive outcomes analysis, operational decision making, discovery research, and public health reporting. the standard doesn't currently cover the reporting of clinically relevant negative or wildtype results within genetic data portion of the message.

[Here](https://www.hl7.org/documentcenter/public_temp_65DE7F6D-1C23-BA17-0CB30D7343EDE16D/wg/clingenomics/docs/V3DAM_CG_CLINSEQ_R1_O1_2013JAN.pdf) is the document of HL7 Version 3 Domain Analysis Model where the examples used in genetics profile are from (Page 5).

**Relationships**

The sequence-genetics-variant profile is designed to be referenced by the [Standard genetics profile](file:///C:\temp\observation-genetics-cg-prf.html). The sequence-genetics-variant profile describes one genetic variant - the DNA variant, DNA variant type, gene and gene region that are inherited from the [Sequence](file:///C:\temp\sequence.html) resource and added constrains to code systems. Other attributes such as observed/reference allele are added as extensions. The element type in the [Sequence](file:///C:\temp\sequence.html) resource is tied to value - "DNA" and variant information about amino acids is stored in extensions - variantAminoAcidChange and variantAminoAcidChangeType considering the format of genetic test reports.

The Card. of the extension - variant (reference to sequence-genetics variant) in the [Standard genetics profile](file:///C:\temp\observation-genetics-cg-prf.html) is 0...\* which makes it convenient and flexible to support genetic test results containing a list of gene mutations or variants.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-introduction.xml**

**Scope and Usage**

The Sequence resource is designed to describe an atomic sequence which contains the alignment sequencing test result and multiple variations. Atomic sequences can be connected by link element and they will lead to sequence graph. By this method, a sequence can be reported. Complete genetic sequence information, of which specific genetic variations are a part, is reported by reference to the GA4GH repository. Thus, the FHIR Sequence resource avoids large genomic payloads in a manner analogous to how the FHIR ImagingStudy resource references large images maintained in other systems. For use cases, details on how this resource interact with other Clinical Genomics resources or profiles, please refer to implementation guidance document [here](file:///C:\temp\genomics.html).

**Genetic Standards and Resources include:**

* Variant Databases: [dbSNP](http://www.ncbi.nlm.nih.gov/projects/SNP/snp_ref.cgi) , [ClinVar](http://www.ncbi.nlm.nih.gov/clinvar/), and [COSMIC](http://cancer.sanger.ac.uk/cosmic/)
* Reference Sequences: [RefSeq](http://www.ncbi.nlm.nih.gov/refseq/) and [ENSEMBL](http://www.ensembl.org/index.html)

This resource is designed to describe sequence variations with clinical significance with information such as:

* Name of the variation represented
* Type of the variation
* Gene region occupied by the variation
* Tissue source used to determine genotype of the variation
* Quality of the result

It is strongly encouraged to provide all available information in this resource for any reported variants, because receiving systems (e.g. discovery research, outcomes analysis, and public health reporting) may use this information to normalize variants over time or across sources. However, these data should not be used to dynamically correct/change variant representations for clinical use outside of the laboratory, due to insufficient information.

Implementers should be aware that semantic equivalency of results of genetic variants cannot be guaranteed unless there is an agreed upon standard between sending and receiving systems.

**Boundaries and Relationships**

Focus of the resource is to provide sequencing alignment data immediately relevant to what the interpretation on clinical decision-making originates from. Hence data such as precise read of DNA sequences and sequence alignment are not included; such data are nonetheless accessible through references to [GA4GH](http://ga4gh.org/#/) (Global Alliance for Genomics and Health) API. The Sequence resource will be referenced by [Observation](file:///C:\temp\observation.html) to provide variant information. As clinical assessments/diagnosis of a patient are typically captured in the [Condition](file:///C:\temp\condition.html) resource or the ClinicalImpression resource, the Sequence resource can be referenced by the Condition resource to provide specific genetic data to support an assertions. This is analogous to how Condition references other resources, such as [AllergyIntolerance](file:///C:\temp\allergyintolerance.html), [Procedure](file:///C:\temp\procedure.html), and [Questionnaire](file:///C:\temp\questionnaire.html) resources.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\sequence\sequence-notes.xml**

**Notes:**

**Sequence Coordinate System**

When saving the variant information, the nucleic acid will be numbered with order. Some files are using 0-based coordiantes (e.g. BCD file format) while some files are using 1-based coordinates (e.g. VCF file format) . The element coordinateSystem in Sequence Resource contains this information.

Sequence.coordinateSystem constraints within two possible values: 0 for 0-based system, which will mark the sequence from number 0, while 1 for 1-based system, which will begin marking the first position with number 1. The significant difference between two system is the end position. In 0-based system, the end position is **exclusive** , which means the last position will not be contained in the sequence window while in 1-based system, the end position is **inclusive** , which means the last position is included in the sequence window. Note both systems has an inclusive start position.

For example, ACGTGCAT will be numbered from 1 to 8 in 1-based system and will be numbered from 0 to 8 in 0-based system to mark flanks (i.e. place between two Nucleotide). So the interval [3,5] in 1-based system is GTG while interval [2,5) in 0-based system is same segment GTG.

**Choice of Strand**

There are lots of definition concerning with the Directionality of DNA or RNA. Here strand element in Sequence resource is defined to have constraints with value +1 and -1 , to indicate what is the direction for nucleotide series. In order to avoid confusion, we use +1 to express the "plus" strand (5' to 3') and -1 to express the "minus" strand (3' to 5'). Here is a very simple mapping that indicates which number the expression will be represented.

|  |  |
| --- | --- |
| **+1** | **-1** |
| Watson | Crick |
| Sense | Antisense |
| positive | negative |

Here is a small-scale example: if 5' GCGATATCGCAAA 3' is the data, then GC..AAA is plus strand while AAA..CG is the minus strand.

**String usage for Reference Sequence and Observed Sequence**

We hope that string of **observedSeq** can be constrained more than just any normal string but with notation tables. Here we present what the nucleotide acid stirng should be constrianed within the range:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A --> adenosine | M --> A C (amino) | U --> uridine | H --> A C T | V --> G C A |
| C --> cytidine | S --> G C (strong) | D --> G A T | K --> G T (keto) |  |
| G --> guanine | W --> A T (weak) | R --> G A (purine) | N --> A G C T (any) |  |
| T --> thymidine | B --> G T C | Y --> T C (pyrimidine) | - --> gap of indeterminate length |  |

while the amino acid string should be constrained within the range:

|  |  |  |  |
| --- | --- | --- | --- |
| A alanine | P proline | B aspartate or asparagine | Q glutamine |
| C cystine | R arginine | D aspartate | S serine |
| E glutamate | T threonine | F phenylalanine | U selenocysteine |
| G glycine | V valine | H histidine | W tryptophan |
| I isoleucine | Y tyrosine | K lysine | Z glutamate or glutamine |
| L leucine | X any | M methionine | \* translation stop |
| N asparagine | - gap of indeterminate length |  |  |

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measure\measure-examples-header.xml**

This example illustrates the use of the Measure resource to describe the CMS9v4 Exclusive Breastfeeding measure. The logic for the measure is specified in the reference library, Exclusive Breatfeeding Measurement Logic.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measure\measure-introduction.xml**

**Scope and Usage**

**This resource is a *definition* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Definition](file:///C:\temp\workflow.html#definition).

The Measure resource represents a structured computable definition of a clinical quality measure. A quality measure is a quantitative tool to assess the performance of an individual or organization with respect to a specified process or outcome via the measurement of actions, processes, or outcomes of clinical care. Quality measures are often derived from clinical guidelines and are designed to determine whether the appropriate care has been provided given a set of clinical criteria and an evidence base.

Note that the Measure itself does not contain any logic; rather a [Library](file:///C:\temp\library.html) resource is referenced that contains the logic required by the measure, and the various expression elements, such as poulation criteria, reference named expressions within that library (or libraries). In addition, if the Measure references multiple libraries, then any expression references within the resource must be qualified with the name of the library that contains the referenced expression.

**Boundaries and Relationships**

The Measure resource describes a specific quality measure, providing the structure of the measure in terms of the calculation elements (the *populations* involved). The [Group](file:///C:\temp\group.html) resource is also capable of describing a population, however, the complexity involved in specifying the criteria in the general case requires the use of a high-level query language such as Clinical Quality Language (CQL). As such, the Measure resource defines only the top-level populations and references CQL expressions for the actual criteria.

A Measure is also similar to an [Observation](file:///C:\temp\observation.html) resource, with the exception that the Measure is purely definitional, it contains no actual measurements, only a description of how to calculate a particular measurement.

A Measure is also similar to a clinical document, but as with the relationship to Observation, a Document is specific to a particular subject.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measure\measure-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measurereport\measurereport-examples-header.xml**

These examples illustrate the use of the MeasureReport resource to report individual, patient-listing, and summary-level results for measure calculation.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measurereport\measurereport-introduction.xml**

**Scope and Usage**

**This resource is an *event* resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html), specifically [Event](file:///C:\temp\workflow.html#event).

The MeasureReport resource represents the results of evaluating a measure for a specific patient or group of patients. The $evaluate-measure operation of the [Measure](file:///C:\temp\measure.html) resource is defined to return a MeasureReport. The resource is capable of representing three different levels of report: patient-level, patient-list, and summary.

The resource draws requirements from the HL7 CDA R2 Implementation Guide: Quality Reporting Document Architecture - Category 1 (QRDA I) DSTU Release 3 (US Realm) and the HL7 Implementation Guide for CDA Release 2: Quality Reporting Document Architecture - Category III (QRDA III), DSTU Release 1 implementation guides.

Note that this resource is a special case of the more general notion of a query evaluation result. However, because the general case requires the ability to represent arbitrary content, this resource uses a simple indicator structure to describe population sizes for each population type defined in the measure. The intent is to be able to represent the more general case as well, either by generalizing this resource, or by making this structure a profile of a more general resource, and we are actively seeking comments about what approaches might be taken to achieve that aim.

**Boundaries and Relationships**

Although the MeasureReport is conceptually an [Observation](file:///C:\temp\observation.html), there is enough specific information required to support the quality reporting use case to warrant a separate resource.

The resource is differentiated from a general purpose query result because it communicates specific information related to quality measurement evaluation that would be difficult to convey generally without imposing some other structure on top of the general results.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\measurereport\measurereport-notes.xml**

**MeasureReport Search**

Although the MeasureReport resource does define search parameters, it is up to the individual measure evaluation service whether or not historical records of measure evaluation requests are preserved. A service may not support searching on MeasureReports at all, or it may support searching only for a pre-defined expiration period. The search parameters are defined to provide consumers with a consistent interface to searching if it is available for a specific service implementation. In any case, services should detail the support they do provide using a CapabilityStatement.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicecomponent\devicecomponent-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicecomponent\devicecomponent-introduction.xml**

**Scope and Usage**

The DeviceComponent resource is used to describe the characteristics, operational status and capabilities of a medical-related component of a medical device. It can be a physical component that is integrated inside the device, a removable physical component, or a non-physical component that allows physiological measurement data and its derived data to be grouped in a hierarchical information organization.

Note:

For the initial scope, this DeviceComponent resource is only applicable to describe a single node in the containment tree that is produced by the context scanner in any medical device that implements or derives from the ISO/IEEE 11073 standard and that does not represent a metric. Examples for such a node are MDS, VMD, or Channel.

**Boundaries and Relationships**

The DeviceComponent allows us to change the configuration of the device without having to change the device resource instance. The life-cycle of the configuration may be completely different than the one of the device itself.

There are several related resources

* [Device](file:///C:\temp\device.html) - Used by the MedicalDeviceSystem profile
* [Patient](file:///C:\temp\patient.html) - Used by the MedicalDeviceSystem profile
* [Location](file:///C:\temp\location.html) - Used by the MedicalDeviceSystem profile
* [DeviceComponent](file:///C:\temp\devicecomponent.html)

**Background and Context**

**Structure of a DeviceComponent Resource**

A Context Scanner object of a medical device that implements or derives from ISO/IEEE 11073 standard is responsible for observing device configuration changes. After instantiation, the Context Scanner object is responsible for announcing the object instances in the device's MDIB, a hierarchical containment (MDS->VMD->Channel->Metric). The DeviceComponent resource can be used to describe the characteristics, operational status and capabilities of a medical-related component of a medical device. It can be a physical component that is integrated inside the device, a removable physical component, or a non-physical component that allows physiological measurement data and its derived data to be grouped in a hierarchical information organization. Devices are conceptualized using the following main structure:

1. **MedicalDeviceSystem** - An actual device that external systems communicate with. In 11073, this is known as a MDS.
2. **VirtualMedicalDevice** - A medical-related subsystem of a medical device. It can either be a physical hardware piece or a pure software plugin component of a medical device. In 11073, this is known as a VMD.
3. **Channel** - A non-physical component that allows physiological measurement data and its derived data to be grouped in a hierarchical information organization.

Very simple devices may have only a single virtual device with a single channel and one metric, while complex devices may have multiple items at every level.

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**Notes:**

* The correct codes for the medical device system (MDS), virtual medical device (VMD), and Channel will be specified in the profiles for specific types of device component. Generally, these codes are registered in the [RTM Management service](https://rtmms.nist.gov), but this is not required. See [Terminology Systems](file:///C:\temp\terminologies-systems.html#urn:iso:std:iso:11073:10101) for the correct representation of these codes in a [Coding](file:///C:\temp\datatypes.html#Coding) data type.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicemetric\devicemetric-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicemetric\devicemetric-introduction.xml**

**Scope and Usage**

The DeviceMetric resource describes mandatory static properties that characterize a direct or derived, quantitative or qualitative biosignal measurement, setting, or calculation produced by a medical device. The DeviceMetric resource can also be used to describe the non-static but highly relevant properties to the metric such as metric status, metric last calibration time and type, measurement mode, color, reference link to the parent DeviceComponent to where it belongs, and any capabilities that the metric offers (for example: setting the metric label).

Note:

For the initial scope, this DeviceMetric resource is only applicable to describe a single metric node in the containment tree that is produced by the context scanner in any medical device that implements or derives from the ISO/IEEE 11073 standard.

**Boundaries and Relationships**

There are two related resources

* [Device](file:///C:\temp\device.html) - The physical device that this DeviceMetric belongs to.
* [DeviceComponent](file:///C:\temp\devicecomponent.html) - The DeviceComponent that this DeviceMetric is part of. This can be a DeviceComponent of any kind like a VirtualMedicalDevice, a MedicalDeviceSystem, or a Channel.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicemetric\devicemetric-notes.xml**

**Notes:**

* The correct codes for the metric types are registered in the [RTM Management service](https://rtmms.nist.gov), but this is not required. See [Terminology Systems](file:///C:\temp\terminologies-systems.html#urn:iso:std:iso:11073:10101) for the correct representation of these codes in a [Coding](file:///C:\temp\datatypes.html#Coding) data type.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\basic\basic-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\basic\basic-introduction.xml**

**Scope and Usage**

**Basic** is a special type of resource. Unlike all other resources, it doesn't correspond to a specific pre-defined HL7 concept. Instead, it's a placeholder for any resource-like concept that isn't already defined in the HL7 specification.

The Basic resource is intended for use in three circumstances:

1. When an implementer needs a resource concept that is likely to be defined by HL7 in the future but they have not yet done so (due to bandwidth issues, lack of sufficient requirements, lower prioritization, etc.)
2. When there's a need to convey a narrative-only construct that doesn't neatly correspond to one of the other resources, either because it combines aspects of several resources (e.g. Assessment + Plan) or because the allowed content is flexible such that the system can't be totally sure what sort of content might have been included in the narrative text.
3. Other than the circumstances above, this resource will see minimal use. To keep the FHIR specification manageable, it cannot incorporate every site-specific requirement that might be needed in some implementation somewhere. This set of resources likely won't ever be officially defined in HL7.

There's also a fourth circumstance: An implementer wishes to convey information that could/should be conveyed using a standard resource, however they want to represent the information in a custom format that isn't aligned with the official resource's elements. While this resource would be the preferred way of meeting that use-case because it will at least be wire-format compatible, such a use would not be conformant because making use of the Basic resource would prevent the healthcare-related information from being safely processed, queried and analyzed by other conformant systems.

Implementers don't need to be concerned with which of the three categories their desired resource fits within. If they need a resource and it clearly doesn't fit one of the ones currently defined, they should use Basic.

**Background and Context**

Basic defines only a minimal set of data elements - those necessary to identify what kind of resource it represents and those necessary to support resource [compartmenting](file:///C:\temp\compartmentdefinition.html). All other data elements are represented using the [extension](file:///C:\temp\extensibility.html) mechanism. It's entirely possible to have a Basic resource instance with nothing other than narrative, a subject and code. And, in practice, that's all many systems will understand.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\basic\basic-notes.xml**

**Why not custom resources?**

Technically, nothing prevents implementers from going off and defining their own resources containing whatever data elements they wish. However, doing so causes several issues:

* Custom resources don't have a discoverability mechanism in the same way custom codes and extensions do using the [ValueSet](file:///C:\temp\valueset.html) and [StructureDefinition](file:///C:\temp\structuredefinition.html) resources. As a result, any implementer that receives a custom resource would have no way of looking up what the meaning of the resource or its elements were. While they could get some sense of meaning from XML or JSON tag names, this often isn't sufficient for safe healthcare interoperability.
* Custom resource names would not be present in the FHIR schemas as allowed elements within the FHIR Bundle schema, would not be present in the enumeration of resources in the Reference type, and would not be supported by any of the autogenerated reference implementations and software interfaces. This would cause issues for any receiving system making use of the schemas directly or via code-generation.
* There is no means of preventing two implementers from independently coming up with the same name for a resource but defining it differently in terms of meaning as well as allowed elements. This would also cause interoperability issues.

All of these concerns are mitigated when there's an assumption that the custom resource will only be used within a narrow constrained environment where all participants will be aware of the semantics, will be using the same custom schemas and there's no chance of collisions. However, HL7's experience is that closed implementation environments rarely remain that way over the long term. Eventually data will need to be shared with others outside the closed environment and all of the above issues will again come into play.

Therefore, use of 'custom' resources is **NOT** considered to be conformant with FHIR. While the use of extensions may make the Basic resource slightly more complex and less visually appealing, it is the only safe and approved mechanism for sharing resource concepts not representable using standard HL7-defined resources.

It is expected that future versions of the interface tooling will be able to generate object interfaces on the basis of profiles. Where this occurs, the complexity of custom resource elements being expressed as extensions should be transparent to the internal code of systems that support that particular variant of the Basic resource. This should further reduce the cost of using 'Basic' as opposed to custom resources.

NOTE: This position is subject to change based on implementation experience. Alternative mechanisms for handling custom resource requirements in a safe manner may be explored. Ideas around alternative technical strategies for managing this issue are welcome.

**Documents and narrative-only resources**

Documents are constructed of sections, where a key part of each section is the narrative. The narratives are stitched together to form the overall text of the document. Many document sections will correspond neatly to resources that are already defined - [List](file:///C:\temp\list.html), [DiagnosticReport](file:///C:\temp\diagnosticreport.html),[FamilyMemberHistory](file:///C:\temp\familymemberhistory.html), etc. However, oddly enough, alignment with FHIR resources isn't always in mind when clinicians and others design documents, and some sections won't neatly align with the boundaries of resources. Sometimes there's simply a need for a place where a document author can say "stuff" without any particular constraints on what they may choose to talk about. Basic is intended to provide a mechanism to handle those circumstances.

Wherever possible, the "standard" FHIR resources should be used, even for narrative-only content. That's because subsequent revisions of the narrative-only content might choose to encode pieces or even all of the narrative content. Encoding can occur with "Basic" as well. Extensions can point to other resources (contained or stand-alone) that fully encode pieces of the free-form narrative found in the Basic resource. If no appropriate other resource exists for the meaning of the content, extensions can also be used.

**Best practices for using 'Basic'**

There are several good practices to follow when making use of the Basic resource:

1. Before using Basic, post a description of the desired resource type on HL7's FHIR list-server or on [Stack Overflow](http://stackoverflow.com/questions/tagged/hl7_fhir) to see whether the use-case can be met by an existing resource. (Sometimes the intended scope of an existing resource won't be clear, even if the intent is to cover your space.) Using an existing resource is usually preferable to using Basic as it significantly increases the likelihood of interoperability.
2. If an existing resource would normally be a good fit for your use-case but can't be used due to overly prescriptive constraints your implementation is unable to meet, again raise the problem on [Stack Overflow](http://stackoverflow.com/questions/tagged/hl7_fhir) so the problem with the specification can be addressed.
3. If it is necessary to make use of the Basic resource, try to use one of the HL7-defined codes for resource type or submit your requirement for a new type for inclusion in the HL7 vocabulary (using the [Propose a change](http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemAdd&tracker_id=677) link), as this will increase the likelihood of interoperability. Alternate code systems are conformant, but are less likely to be recognized or re-used across the healthcare implementation space.
4. Architect your interface in a way that will make it less painful to swap your use of Basic with an 'official' resource in the event that a future release of FHIR formally defines a resource that encompasses your use-case.
5. Use a [StructureDefinition](file:///C:\temp\structuredefinition.html) to define the extensions relevant to each type of other resource used. Profile can also be used to define additional search criteria appropriate for the resource.
6. When defining a profile on Basic, include mappings to the w5 categories to allow systems to easily manage [AuditEvent](file:///C:\temp\auditevent.html) and [Provenance](file:///C:\temp\provenance.html) uses as well as other potential higher-level abstractions of the data.
7. As well, profiles should consider how best to handle common notions such as "Entered in error" status and alignment with common practices within similar resource families (other request resources, medication-related resources), etc.

**Referencing Basic resources**

None of the standard resources will have direct references to Basic, aside from those that allow linking to "Any" resource. As a result, most references to "Basic" will need to be performed using extensions.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\binary\binary-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\binary\binary-introduction.xml**

**Scope and Usage**

There are situations where it is useful or required to handle pure binary content using the same framework as other resources. Typically, this is when the binary content is referred to from other FHIR Resources. Using the same framework means that the existing servers, security arrangements, code libraries etc. can handle additional related content. Typically, Binary resources are used for handling content such as:

* [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) Documents (i.e. with XDS)
* PDF Documents
* Images (the Media resource is preferred for handling images, but not possible when the content is already binary - XDS)

A binary resource can contain any content, whether text, image, pdf, zip archive, etc. These resources are served in their native form on the rest interface, but can also be represented in XML or JSON, such as when including these resources in a bundle (used when it is convenient to include these in the feed directly rather than leaving them by reference).

**Boundaries and Relationships**

This resource is generally used as the target of a [Document Reference](file:///C:\temp\documentreference.html) or an [Attachment](file:///C:\temp\datatypes.html#Attachment), when a FHIR server finds it convenient to manage the content within the same overall REST framework as the other resources.

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**Serving Binary Resources using the RESTful API**

Binary resources behave slightly differently to all other resources on the RESTful API. Specifically, when a read request is made for the binary resource that doesn't explicitly specify the FHIR content types "application/fhir+xml" or "application/fhir+json", then the content should be returned using the content type stated in the resource. e.g. if the content type in the resource is "application/pdf", then the content should be returned as a PDF directly.

Note that due to the way the web infrastructure works, it is not possible to make blanket rules about the relationship between the "Accept" field in the HTTP request, and the return type, which is why there is no hard rule about this. However the intent is that unless specifically requested, the FHIR XML/JSON representation is not returned.

Note that in the native binary representation, the normal resource [metadata](file:///C:\temp\resource.html#meta) is not available directly, though some of it is replicated in the HTTP response headers. Specifically, the following elements of the resource have matching HTTP Headers:

* **Binary.meta.lastUpdated**: Last-Modified
* **Binary.meta.versionId**: ETag header
* **Binary.contentType**: Content-Type
* **Binary.securityContext**: X-Security-Context - this is a FHIR specific extension, primarily intended to allow a the security context for a Binary resource to be specified when it is posted in native form

When a binary is written the server ([create](file:///C:\temp\http.html#create)/[update](file:///C:\temp\http.html#update) - POST or PUT), the data is accepted as is and treated as a the binary content of a Binary, including when the content type is "application/fhir+xml" or "application/fhir+json", except for the special case where the content is actually a Binaryresource.

Note that when client requests a binary resource using a generic mime type (application/xml, text/xml, or application/json), the server SHOULD return the content directly if the content-type format matches the requested mime type (e.g. if the Accept header is appplication/json, and the contentType is vnd.xacml+json). However servers may not always be able to interpret mime types correctly, and clients SHOULD be prepared to receive either format.

Note that the \_summary parameter does not apply when the mime type is not one of the stanard FHIR content types.

**Security Considerations**

Binary resources are not constrained, and therefore can be of any content type and encoding. Therefore extra care needs to be taken to validate the content of the Binary resource against malicious or malformed content. For more details see [Security of Narrative](file:///C:\temp\security.html#narrative).

Very often, the content of a binary resource is sensitive, and the server should apply appropriate access control to the content. When the server itself generates the content, it implicitly knows what access control to apply. When the client provides the binary to the server itself, it uses the securityContext element (or the matching X-Security-Context HTTP header) to inform the server that the Binary resource should be treated as if it was the other resource. Typically, the other resource is a DocumentReference or similar resource that refers directly to the Binary resource, but that is not mandatory.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bundle\bundle-examples-header.xml**

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In addition to the examples below, there are other examples of Bundles through the specification:

* [Document](file:///C:\temp\document-example-dischargesummary.html)
* [Message Request](file:///C:\temp\message-request-link.html)
* [Message Response](file:///C:\temp\message-response-link.html)
* [Collection](file:///C:\temp\diagnosticreport-examples.html)

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bundle\bundle-introduction.xml**

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**Scope and Usage**

One common operation performed with resources is to gather a collection of resources into a single instance with containing context. In FHIR this is referred to as "bundling" the resources together. These resource bundles are useful for a variety of different reasons, including:

* Returning a set of resources that meet some criteria as part of a server operation (see [RESTful Search](file:///C:\temp\http.html#search))
* Returning a set of versions of resources as part of the history operation on a server (see [History](file:///C:\temp\http.html#history))
* Sending a set of resources as part of a message exchange (see [Messaging](file:///C:\temp\messaging.html))
* Grouping a self-contained set of resources to act as an exchangeable and persistable collection with clinical integrity - e.g. a clinical document (see [Documents](file:///C:\temp\documents.html))
* Creating/updating/deleting a set of resources on a server as a single operation (including doing so as a single atomic transaction) (see [Transactions](file:///C:\temp\http.html#transaction))
* Storing a collection of resources

**Boundaries and Relationships**

There are two ways to collect resources together for transport and persistence purposes - [contained resources](file:///C:\temp\references.html#contained), and bundles. There is an important difference between the two:

* Contained resources are "in" the container resource - they can only ever be interpreted and/or changed in the context of the container
* A bundle is a collection of resources that have an independent existence - for example, they can also be accessed directly using the [RESTful API](file:///C:\temp\http.html)

In addition to these two technical mechanisms, there are three administrative and infrastructure resources which also support grouping of content:

* The [List](file:///C:\temp\list.html) resource â€“ Enumerates a flat collection of resources and provides features for managing the collection. While a particular List instance may represent a "snapshot", from a business process perspective the notion of "List" is dynamic â€“ items are added and removed over time. The list resource references other resources. Lists may be curated and have specific business meaning.
* The [Group](file:///C:\temp\group.html) resource â€“ Defines a group of specific people, animals, devices, etc. by enumerating them, or by describing qualities that group members have. The group resource refers to other resources, possibly implicitly. Groups are intended to be acted upon or observed as a whole; e.g. performing therapy on a group, calculating risk for a group, etc. This resource will commonly be used for public health (e.g. describing an at-risk population), clinical trials (e.g. defining a test subject pool) and similar purposes.
* The [Composition](file:///C:\temp\composition.html) resource â€“ Defines a set of healthcare-related information that is assembled together into a single logical document that provides a single coherent statement of meaning, establishes its own context and that has clinical attestation with regard to who is making the statement. The composition resource provides the basic structure of a FHIR [document](file:///C:\temp\documents.html). The full content of the document is expressed using a bundle. Compositions will often reference Lists as the focus of particular sections.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bundle\bundle-notes.xml**

**Notes about Bundle**

* Conceptually, a bundle is a list of resources with some context (named links, and status on the entries)
* Since a Bundle is itself a [Resource](file:///C:\temp\resource.html) it has the same common metadata as all resources, including profile assertions, tags, and security labels
* Although there are no extensions on the Bundle itself, link, entry, and search/request/response can all have extensions. See [Patient](file:///C:\temp\patient.html#match) and [Location](file:///C:\temp\location.html#positional) for examples on search
* Both Bundle.link and Bundle.entry.link are defined to support providing additional context when bundles are used (e.g. [HATEOAS](http://en.wikipedia.org/wiki/HATEOAS)). Bundle.entry.link corresponds to links found in the HTTP header if the resource in the entry was [read](file:///C:\temp\http.html#read) directly. This specification defines some specific uses of Bundle.link for [searching](file:///C:\temp\search.html#conformance) and [paging](file:///C:\temp\http.html#paging), but no specific uses for Bundle.entry.link, and no defined function in a transaction - meaning is implementation specific
* Bundles have both .id and .identifier - see [Resource Identities](file:///C:\temp\resource.html#id) for further information

**Using Bundles**

The content and rules for using a Bundle depend on the [type](file:///C:\temp\bundle-definitions.html#Bundle.type) of the bundle. Note that all bundle types use resource identity resolution as described below.

**Document**

A document bundle (type = "document") consists of a series of entries, the first of which is a [Composition](file:///C:\temp\composition.html). Each entry element SHALL contain a resource. See [Documents](file:///C:\temp\documents.html) for further information.

[Example](file:///C:\temp\document-example-dischargesummary.html)

**Message**

A message bundle (type = "message") consists of a series of entries, the first of which is a [MessageHeader](file:///C:\temp\messageheader.html). Each entry element SHALL contain a resource. See [Messaging](file:///C:\temp\messaging.html) for further information.

Example [Request](file:///C:\temp\message-request-link.html) and [Response](file:///C:\temp\message-response-link.html)

**Search Results**

A set of search results (type = "searchset") consists of a series of 0 or more entries. Each entry element SHALL contain a resource. See [Search](file:///C:\temp\http.html#search) for further information.

In addition, [Bundle.total](file:///C:\temp\bundle-definitions.html#Bundle.total) may be used to return the total number of resources that match the search, and that may be returned by following the "next" [link](file:///C:\temp\bundle-definitions.html#Bundle.link).

For each entry, a search set can also contain two specific pieces of search related information:

* [search.mode](file:///C:\temp\bundle-definitions.html#Bundle.entry.search.mode): An indication of whether the resource is in the search set because it matched the search criteria, or whether it is included because another resource refers to it (e.g. by the [\_include](file:///C:\temp\search.html#include) parameter)
* [search.score](file:///C:\temp\bundle-definitions.html#Bundle.entry.search.score): The server's search ranking score for the entry. Servers are not required to return a ranking score, but if they do, 1 is most relevant, and 0 is least relevant. Note: often, search results are sorted by score, but the client may specify a different sort order (see [Search Relevance](file:///C:\temp\search.html#score)

[Example](file:///C:\temp\bundle-example.html)

**History**

An change history (type = "history") consists of a series of 0 or more entries. Each entry element SHALL contain a request element that describes the change that was made, and, if the method is a POST or PUT, a resource that represents the state of the resource at the conclusion of the operation. See [History](file:///C:\temp\http.html#history) for further information.

In addition, [Bundle.total](file:///C:\temp\bundle-definitions.html#Bundle.total) may be used to return the total number of resources that are included in the change history, and that may be returned by following the "next" [link](file:///C:\temp\bundle-definitions.html#Bundle.link).

4

Example to do

**Transaction / Batch**

A transaction (type = "transaction") or batch (type = "batch") consists of a series of 0 or more entries. Each entry element SHALL contain either a request element, or a resource element (or both). See [Transactions](file:///C:\temp\http.html#transaction) for further information. Each entry in a transaction has the details of an HTTP operation that informs the system processing the transaction what to do with the entry. If the entry method is a 'PUT' or 'POST', then the entry SHALL contain a resource that becomes the body of the HTTP operation.

If there is no request element, then there SHALL be a resource and the server must infer whether this is a create or an update from the resource identity supplied.

[Example](file:///C:\temp\bundle-transaction.html)

**Transaction/batch Response**

A transaction response (type = "transaction-response") or batch response (type="batch-response") consists of a series of 0 or more entries, 1 for each entry in the transaction or batch it is in response to. Each entry element SHALL contain a response element which indicates the outcome of the HTTP operation that the server performed for the entry.

[Example](file:///C:\temp\bundle-response.html)

**Collection**

A collection (type = "collection") consists of a series of 0 or more entries. No particular use with respect to the FHIR specification is associated with this bundle. Each entry element SHALL contain a resource.

[Example](file:///C:\temp\diagnosticreport-examples.html)

**Resource URL & Uniqueness rules in a bundle**

Except for transactions and batches, Each entry in a Bundle must have a fullUrl which is the identity of the resource in the entry. Note that this is not a versioned reference to the resource, but its identity. Where a resource is not assigned a persistent identity that can be used in the bundle, a UUID should be used (urn:uuid:...).

For transactions and batches, entries may not have fullURLs when the entry.request.method = POST, and the resource has no identity. Note that even in this case, there may still be a fullURL in a transaction on a POST so that relationships between resources can be represented (see [Transactions](file:///C:\temp\http.html#transaction)).

In some bundles, a given resource can only appear once:

|  |  |
| --- | --- |
| **Type** | **Rules** |
| document | no duplicates |
| message | no duplicates (generally not, unless noted explicitly in the event definition e.g. for messaging deltas?) |
| transaction | no duplicates allowed |
| transaction-response | no duplicates allowed |
| batch | no duplicates allowed |
| batch-response | no duplicates allowed |
| history | yes, duplicates are allowed |
| searchset | no duplicates allowed |
| collection | yes, duplicates are allowed, though generally would not be a good idea |

**Resolving references in Bundles**

The Bundle resource is a packaging construct that has one of more entries that are other kinds of resources. Those resources themselves have references to other resources - e.g. an Observation that refers to a Patient. The referenced resources may also be found in the bundle. For example, the system that constructed the bundle may have included both the observation and the patient. The content of the references between resources doesn't change because of the bundle.

This section documents a method that resolves references correctly within a bundle. Note that this method does not define any new semantics; resolution is based on the way resource identity and resource references work.

Applications reading a bundle should always [look for a resource](file:///C:\temp\references.html#bundle-refs) by its identity in the bundle first before trying to access it by its URL.

How to resolve a reference in a bundle:

1. If the reference is not an absolute reference, convert it
   * If the fullUrl starts with urn:uuid: or urn:oid:, then append the id to the base URL and try to resolve within the bundle as for a RESTful URL reference. If no resolution is possible, then the reference has no defined meaning within this specification
   * if the fullUrl of the resource that contains the reference is a RESTful one (see the [RESTful URL regex](file:///C:\temp\references.html#regex)), extract the [[root]](file:///C:\temp\http.html#root), and append the reference to it
   * otherwise, treat the fullUrl as a normal URL, and follow the normal method for [Resolving Relative References to Absolute Form](https://tools.ietf.org/html/rfc2396#section-5.2)
2. Look for an entry with a fullUrl that contains the URL in the reference
   * If no match is found, the resource is not in the bundle, and must be found elsewhere (e.g. if an http: URL, try accessing it directly)
   * If multiple matches are found, it is ambiguous which is correct

If the reference is version specific (either relative or absolute), then remove the version from the URL before matching fullUrl, and then match the version based on Resource.meta.versionId. Note that the rules for resolving references in contained resources are the same as those for resolving resources in the resource that contains the contained resource.

Here is an example Bundle the demonstrates these rules:

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

<type value="collection"/>

<!-- A patient that already has an id on a server -->

<entry>

<fullUrl value="http://example.org/fhir/Patient/23"/>

<resource>

<Patient>

<id value="23"/>

</Patient>

</resource>

</entry>

<!-- A patient that doesn't have a persistent home - but it does have

a UUID assigned for this bundle "locally identified" -->

<entry>

<fullUrl value="urn:uuid:04121321-4af5-424c-a0e1-ed3aab1c349d"/>

<resource>

<Patient>

</Patient>

</resource>

</entry>

<!-- a relative resource reference -->

<entry>

<fullUrl value="http://example.org/fhir/Observation/123"/>

<resource>

<Observation>

<id value="123"/>

<subject>

<!-- this is reference to the first resource above -->

<reference value="Patient/23"/>

</subject>

</Observation>

</resource>

</entry>

<!-- an absolute reference -->

<entry>

<fullUrl value="http://example.org/fhir/Observation/124"/>

<resource>

<Observation>

<id value="124"/>

<subject>

<!-- this is reference to the first resource above -->

<reference value="http://example.org/fhir/Patient/23"/>

</subject>

</Observation>

</resource>

</entry>

<!-- reference to a locally identified resource -->

<entry>

<fullUrl value="http://example.org/fhir/Observation/12"/>

<resource>

<Observation>

<id value="12"/>

<subject>

<!-- reference to the second patient above -->

<reference value="urn:uuid:04121321-4af5-424c-a0e1-ed3aab1c349d"/>

</subject>

</Observation>

</resource>

</entry>

<!-- reference that doesn't resolve in this bundle -->

<entry>

<fullUrl value="http://example.org/fhir/Observation/14"/>

<resource>

<Observation>

<id value="14"/>

<subject>

<!-- reference to a patient not found in this bundle -->

<reference value="http://example.org/fhir-2/Patient/1"/>

</subject>

</Observation>

</resource>

</entry>

</Bundle>

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\capabilitystatement\capabilitystatement-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\capabilitystatement\capabilitystatement-introduction.xml**

**Scope and Usage**

The capability statement is a key part of the overall conformance framework in FHIR. It is used as a statement of the features of actual software, or of a set of rules for an application to provide. This statement connects to all the detailed statements of functionality, such as [StructureDefinitions](file:///C:\temp\structuredefinition.html) and [ValueSets](file:///C:\temp\valueset.html). This composite statement of application capability may be used for system compatibility testing, code generation, or as either the basis for a conformance assessment. For further information about Conformance testing, see [Conformance Rules](file:///C:\temp\conformance-rules.html) and [Profiling FHIR](file:///C:\temp\profiling.html).

Specifically, capability statements are used in one of three ways:

**Describe an actual implementation**

In this scenario, the capability statement describes the capabilities of a deployed and configured solution available at a particular access point or set of access points. The statement describes exactly how to interface with that deployed solution and thus provides for a degree of self-configuration of software solutions.

This is the type of profile that FHIR restful solutions are expected to make available on invocation of the *capabilities* operation. It is also the type of statement that forms a basis for the testing, certification or commissioning of specific software installations.

**Describe software solution capabilities**

In this scenario, the capability statement describes generic capabilities of a software application or component solution. The solution might be available for purchase or other acquisition and might be deployed and configured at any number of independent sites. Because it is not dependent on any particular implementation, the profile cannot provide specific details such as endpoint addresses. It may also need to document various configurations in which the application can be set up or describe the degree of customizability associated with the solution.

This type of statement may be used as a marketing tool by software and system developers to formally describe their capabilities. It can also be used as the basis for conformance testing of software solutions independent of a particular installation.

**Describe a desired solution**

In this scenario, the capability statement describes the capabilities of a desired system. It might be used as part of an architectural design process to document needed system capabilities, or might be used as part of an RFP process to formally document the requirements of a requested solution and to document the criteria by which proposals will be evaluated.

These three types of profiles can be used together. A requirements statement can be compared against the solution statements proffered by respondents to an RFP. A solution statement for a software package forms the starting point for the implementation statement associated with a particular installation of that software package.

**Background and Context**

Capability Statements provide for a degree of automatic configuration and adaptation. However, capturing absolutely every variation that could impact the interoperability of two systems, let alone keeping that detailed information up-to-date as systems evolve through maintenance and upgrades is rarely practical. Therefore, capability statements should be seen as an interim step. They provide a degree of automation. However, they also provide a great deal of human-readable content that can minimize the need for direct communication between the operators of the systems being configured to interoperate.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\capabilitystatement\capabilitystatement-notes.xml**

**Notes:**

* The CapabilityStatement resource provides for an application to describe its use of the RESTful paradigm messaging events, or FHIR documents. Usually, an application would only describe one, but more than one may be described
* RESTful CapabilityStatement rules:
  + RESTful servers are required to provide [this resource on demand](file:///C:\temp\http.html#capabilities). Servers SHALL specify what resource types and operations are supported, and SHOULD also specify profiles for each resource type.
  + RESTful clients SHOULD publish a capability statement
  + The search parameters that a server supports (or a client makes use of) are specified in the resource profile that the capability statement references
  + Resource Types or operations that are not listed are not supported
* Messaging CapabilityStatement rules:
  + The interpretation of request and response depends on the mode. If the mode is sender, then request specifies what the application sends, and response specifies what it accepts. If the mode is "receiver", then this is reversed
  + If a request or response is not specified for an event, then no rules are made for it
  + Events that are not listed are not supported
  + The [MessageDefinition](file:///C:\temp\messagedefinition.html) resource is newly proposed and is still considered 'draft'. The supportedMessage element can be used in place of the event and the work group believes it may meet implementer needs better, however because the new mechanism has not yet been reviewed by ballot, the older 'event' mechanism has been retained. Implementers may use one or the other to define their capabilities. Feedback is welcome.
* Document CapabilityStatement rules:
  + Document profiles should directly constrain the Document.information.class & type elements so that there is no ambiguity concerning which profile any given document conforms to.
* Other service based use of resources: Due to the variability of these services, the CapabilityStatement resource does not attempt to describe service based use of resources. The various service specifications will need to describe this usage in their own way.

**Supporting Profiles**

A CapabilityStatement declares two different kinds of profiles for the functionality it describes. For a discussion of the use of these two types of resources, see [two uses for profiles](file:///C:\temp\profiling.html).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\compartmentdefinition\compartmentdefinition-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\compartmentdefinition\compartmentdefinition-introduction.xml**

**Scope and Usage**

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

**Note:**

At present, CompartmentDefinitions can *only* be defined by HL7 International. This is because their existence creates significant impact on the behavior of servers.

**Boundaries and Relationships**

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:

<%compartmentlist%>

The full definitions of these compartments are published as CompartmentDefinition resources. Servers typically do not support the full definition of a compartment, and are not required to. Systems may publish CompartmentDefinition resources so that other systems may make use of compartments properly.

* CompartmentDefinitions are used by [CapabilityStatement](file:///C:\temp\capabilitystatement.html) instances for specifying how resources are accessed

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\compartmentdefinition\compartmentdefinition-notes.xml**

**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

Note that the outcome of a compartment search is the same as the equivalent normal search. As an example, both these searches return the same outcome if there is no patient 333:

GET [base]/Patient/333/Condition

GET [base]/Condition?patient=333

Whether the patient doesn't exist, or the user has no access to the patient, both these searches return an empty bundle with no matches. Some systems will include an operation outcome warning that there is no matching patient.

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:\temp\compartmentdefinition-patient.html) for [Communication](file:///C:\temp\communication.html)says that a Communication 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]/Communication?subject=[id]

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

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

There is no way to do this as a single search, except by using the [\_filter](file:///C:\temp\search_filter.html):

GET [base]/Communication?\_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:\temp\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:\temp\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:\temp\diagnosticreport.html) identifies a subject, but an [Observation](file:///C:\temp\observation.html) it references identifies a different subject, or where a [List](file:///C:\temp\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:\temp\medication.html), [Substance](file:///C:\temp\substance.html), [Location](file:///C:\temp\location.html). These resources are not directly to a patient or authored record, and are sometimes 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.

**Defining New Compartments**

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.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\domainresource\domainresource-introduction.xml**

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**Scope and Usage**

A domain resource is an resource that:

* has a human-readable XHTML representation of the content of the resource (see [Human Narrative in resources](file:///C:\temp\narrative.html))
* can contain additional related resources inside the resource (see [Contained Resources](file:///C:\temp\references.html#contained))
* can have additional extensions and modifierExtensions as well as the defined data (See [Extensibility](file:///C:\temp\extensibility.html))

As an abstract resource, this resource is never created directly; instead, one of its descendent resources ([see List of Resources](file:///C:\temp\resourcelist.html)) is created.

**Boundaries and Relationships**

This resource extends the base [resource](file:///C:\temp\resource.html). All of the listed [Resources](file:///C:\temp\resourcelist.html) except [Bundle](file:///C:\temp\bundle.html), [Parameters](file:///C:\temp\parameters.html) and [Binary](file:///C:\temp\binary.html) extend this resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\domainresource\domainresource-notes.xml**

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**Searching Extensions**

To search for extensions, define a search parameter for the extension. All other search parameters are named aliases for existing content in the resource. In some cases, though not all, the search parameter name is the same as the element that it searches, but this is not required. Searching for extensions is the same - define a name that identifies the value extension by its URL, and then searches can filter based on the value of the extension.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\graphdefinition\graphdefinition-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\graphdefinition\graphdefinition-introduction.xml**

**Scope and Usage**

The GraphDefinition resource provides a formal computable definition of a graph of resources - that is, a coherent set of resources that form a graph by following references. The Graph Definition resource defines a set and makes rules about the set. The GraphDefinition resource can be used to:

* Summarize a set of profiles on resources
* Define a graph of resources to return in a query
* Define a graph of resources to include in a document
* Document rules about the relationship between a set of resources e.g. must all resources concern the same patient?

**Boundaries and Relationships**

There is a close relationship between [Profiles](file:///C:\temp\structuredefinition.html) and GraphDefinitions:

* A StructureDefinition defines a profile, and profiles can make rules about the relationships between resources. A carefully defined set of profiles implies part of what is in a GraphDefinition
* A GraphDefinition defines rules about the relationships between resources, and in so doing, implies some constraints that would need to be represented in their profiles

Profiles and Graph Definitions can be used together, or separately. When used together, they should be consistent. Note, though, that a graph definition may contain a subset or a superset of the relationships explicitly described in the profiles it refers to.

It is possible that in some circumstances, a GraphRelationship makes incompatible rules with the Profiles it refers to - in this case, no graph if resources will meet the constraints expressed. Applications should - but are not required - detect when such incompatibilities arise.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\graphdefinition\graphdefinition-notes.xml**

**Using GraphDefinitions**

The GraphDefinition resource can be used to:

* Summarize a set of profiles on resources
* Define a graph of resources to return in a query
* Define a graph of resources to include in a document
* Document rules about the relationship between a set of resources e.g. must all resources concern the same patient?

**Summarize a set of profiles on resources**

FHIR resources are relatively granular. In many/most cases, many resources are needed to handle any particular task. A typical example of this is a complex diagnostic report: it will start with a DiagnosticReport, which will link to a set of panels (Observation resources), each of which link to a set of Observation resources for atomic data items.

One way to represent this is to profile each of the resources, creating 100s of profiles, and then leave it to the user to infer the overall pattern of the report from the detailed profiles for each observation in the report. But it's not easy to see the forest for the trees. A GraphDefinition can summarise the overall picture and present a summary to the user.

Here's [an example](http://fhir.hl7.org.au/fhir/rcpa/pprofiles.html) of the kind of summary this represents. (Todo: make this an actual graph definition, and clone into the main spec)

**Fetching a graph of resources**

As another example of using many resources, to describe a medication dispense, an application needs, in addition to the MedicationDispense resource that describes the actual dispense, and application will typically retrieve resources for the patient, provider, organizations, and the prescription for the dispense.

A client can retrieve a single resource:

GET [base]/MedicationDispense/example

Then, when it reads the returned resource, if can fetch the referenced resources:

GET [base]/Patient/example

GET [base]/Practitioner/example

GET [base]/MedicationRequest/example

... etc

This is a very inefficient way to retrieve all the required resources. An alternative approach is to do a search, and \_include the required resources:

GET [base]/MedicationDispense?\_id=example

&\_include=MedicationDispense.authorizingPrescription

&\_include=MedicationDispense.subject

But scaling up this approach to fetch a full package with it's dependencies becomes increasingly difficult as the package gets deeper. A graph definition can be used instead of inform the server what to return as part of the search:

GET [base]/MedicationDispense?\_id=example&\_graph=med-package

This is a reference to the local graph package 'med-package', with the intent that the server returns the graph as outlined by the definition. In this case, the graph definition would look approximately like this:

MedicationDispense

.subject

.context

.performer.actor

.authorizingPrescription

.requester.agent

.substitution.responsibleParty

**Building a document**

A very similar issue applies when building a document using the [$document operation](file:///C:\temp\composition-operations.html#document). A document must include all the resources linked directly from the composition, but whether to include additional linked resources is at the discretion of the document author. How does the user inform the $document operation which linked resources to include? One option is a boolean flag for including **all** linked data, but this may be extensive - up to an entire patient record - and may include resources that are not desired.

An operation can use a graph definition as a parameter to the $document operation:

GET [base]/Composition/example/$document?graph=example

This tells the server to include the graph of resources defined in the [example GraphDefinition](file:///C:\temp\graphdefinition-example.html) - in this case, any resources referred to from lists, when the section content is a list.

**Document Relationship rules**

One important question about the use of resources is cross-resource consistency. For example, if an Observation refers to both a Patient and Encounter, does the Encounter have to refer to the same patient?

In general, the answer to this is that it usually should - the record needs to be consistent. However there are edge cases where the references may differ. For example, with regard to patient references, they may differ for:

* Health Records concerning mother and baby
* Organ Transplants
* Counselling, particularly family counselling

Other reasons for the references to differ - mixing records about the same patient from different servers, or specific records about patients mixed with records about groups of patients (particularly common in veterinarian care).

The GraphDefinition resource allows for compartment consistency rules to be made regarding the links between resources. For each link in the graph, the graph definition can make a rule about the compartment consistency. The rule can specify one of the following consistencies:

|  |  |
| --- | --- |
| **Code** | **Meaning** |
| identical | The compartment must be identical (the same literal reference) |
| matching | The compartment must be the same - the record must be about the same patient, but the reference may be different |
| different | The compartment must be different |
| custom | The compartment rule is defined in the accompanying FHIRPath expression |

Todo: how would this be validated? - where is the graph referred to?

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\group\group-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\group\group-introduction.xml**

**Scope and Usage**

**Use Cases**

The group resource is used in one of two ways:

1. To define a group of specific people, animals, devices, etc. that is being tracked, examined or otherwise referenced as part of healthcare-related activities
2. To define a set of \*possible\* people, animals, devices, etc. that are of interest for some intended future healthcare-related activities

Examples of the former could include group therapy or treatment sessions, exposed entities tracked as part of public health, etc. The latter might be used to define expected subjects for a clinical study.

Both use cases are handled by a single resource because the data elements captured tend to be similar.

**Boundaries and Relationships**

There are five mechanisms in FHIR for communicating collections of resources:

* The [List](file:///C:\temp\list.html) resource - enumerates a flat collection of resources and provides features for managing the collection. While a particular List instance may represent a "snapshot", from a business process perspective the notion of "List" is dynamic â€“ items are added and removed over time. The list resource references other resources. Lists may be curated and have specific business meaning.
* This Group resource - defines a group of specific people, animals, devices, etc. by enumerating them, or by describing qualities that group members have. The group resource refers to other resources, possibly implicitly. Groups are intended to be acted upon or observed as a whole; e.g. performing therapy on a group, calculating risk for a group, etc. This resource will commonly be used for public health (e.g. describing an at-risk population), clinical trials (e.g. defining a test subject pool) and similar purposes.
* The [Bundle](file:///C:\temp\bundle.html) resource - is an infrastructure container for a group of resources. It does not have narrative and is used to group collections of resources for transmission, persistence or processing (e.g. messages, documents, transactions, query responses, etc.) The content of bundles is typically algorithmically determined for a particular exchange or persistence purpose.
* The [Composition](file:///C:\temp\composition.html) resource - defines a set of healthcare-related information that is assembled together into a single logical document that provides a single coherent statement of meaning, establishes its own context and that has clinical attestation with regard to who is making the statement. The composition resource provides the basic structure of a FHIR [document](file:///C:\temp\documents.html). The full content of the document is expressed using a bundle. Compositions will often reference Lists as the focus of particular sections.
* The [DomainResource](file:///C:\temp\domainresource.html).contained element - allows multiple resources to be nested inside any DomainResource. This is a special type of grouping where the grouped resources lose independent existence - they no longer have their own identifiers, can't easily be queried independently, etc. Use of this grouping is a technical mechanism for managing the independence of resources and has no impact on meaning. Contained, bundles and remotely referenced resources convey the same meaning.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\group\group-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\implementationguide\implementationguide-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\implementationguide\implementationguide-introduction.xml**

**Scope and Usage**

An "implementation guide" defines a particular scope of usage for FHIR, and sets a bounded set of expectations for implementations to comply to.

The significant conformance expectation introduced by the ImplementationGuide resource is the idea of [Default Profiles](file:///C:\temp\intros%20and%20notes.html#default). Implementations may conform to multiple implementation guides at once, but this requires that the implementation guides are compatible (see [below](file:///C:\temp\intros%20and%20notes.html#compatibility)).

**Boundaries and Relationships**

Implementation Guides contain two different types of resource references:

* Contents: A set of logical statements which implementations must conformn to. These are almost always [conformance resources](file:///C:\temp\conformance-module.html)
* Examples: Examples that illustrate the intent of the profiles defined in the implementation guide. These can be any kind of resource

An applications [Capability Statement](file:///C:\temp\capabilitystatement.html) may identify one or more implementation guides that an application conforms to.

**Background and Context**

The ImplementationGuide resource is defined for two principle reasons:

* As a logical statement of the implementation guide contents for conformance tools to use to evaluate conformance
* For the FHIR project tools, to support publishing implementation guides

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\implementationguide\implementationguide-notes.xml**

**Default Profiles**

An implementation guide can define default profiles - these are profiles that apply to any resource that does not otherwise have an explicit profile assigned by the implementation guide. Default profiles are always references to profiles ([StructureDefinition](file:///C:\temp\structuredefinition.html) resources) that are also contained in the resources. By defining default profiles, an implementation guide can save itself from exhaustively defining profiles on every resource type just to profile every reference to a particular resource type.

Note that a resource can conform to the default profile by conforming to any profile derived from it.

**Compatibility list**

This table declares the compatibility between the various resources as determined by the Implementation Guide comparison tool:

*Yet to be done*

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\list\list-ccda-cognitivestatuses-introduction.xml**

**Scope and Usage**

This is FHIR Profile is mapped from the Cognitive Status Result Organizer CCDA EntryTemplate : *HL7 Implementation Guide for CDA R2: IHE Health Story Consolidation, DSTU R1.1*, 5.15 Cognitive Status Result Organizer [organizer: templateId 2.16.840.1.113883.10.20.22.4.75 (open)]

This clinical statement identifies a set of cognitive status result observations. It contains information applicable to all of the contained cognitive status result observations. A result organizer may be used to group questions in a Patient Health Questionnaire (PHQ). An appropriate nullFlavor can be used when the organizer/code or organizer/id is unknown.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\list\list-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\list\list-introduction.xml**

**Scope and Usage**

The List resource is a flat, possibly ordered, collection of records. List resources are used in many places, including allergies, medications, alerts, family history, medical history, etc. List resources can be used to support patient-specific clinical lists as well as lists that manage workflows such as tracking patients, managing teaching cases, etc. Resources supported by the List resource can be homogenous â€“ consisting of only one type of resource (e.g., allergy list); as well as heterogeneous â€“ containing a variety of resources (e.g., a problem list including [Conditions](file:///C:\temp\condition.html), [AllergyIntolerances](file:///C:\temp\allergyintolerance.html), recent [Procedures](file:///C:\temp\procedure.html), etc.).

Lists will typically include references to the resources that make up the list, however in some cases the details of the content of the list might be expressed in narrative only; e.g., a text record of a family history. The List resource is only needed if there is a need to filter the set of resources by a mechanism that cannot be accomplished via a simple query; i.e. there is no need to have a list for all [AllergyIntolerances](file:///C:\temp\allergyintolerance.html) that exist on a server for a given patient. However, List is an appropriate mechanism to provide a filtered list of the subset of AllergyIntolerances that are deemed to be "current". Lists are allowed to contain other lists, so that there is a nested collection of lists.

Querying a List of resources such as AllergyIntolerance, Condition or Medication-related resources is different than querying the resource-specific end point. For example, a List of AllergyIntolerance would represent a curated point-in-time snapshot of the patient's allergies and intolerances. On the other hand, querying the AllergyIntolerance endpoint would typically produce a larger set of records as it would both be non-currated (potentially containing duplicate or out-of-date records) as well as current - generated based on information as of "now" rather than the last time a human manually revised the List resource instance. Which mechanism is most appropriate for data retrieval will vary by use-case. In some cases, systems may not have an appropriate currated List to query.

Note that the presence of an item in a List resource SHALL NOT change the meaning of any information that would be understood by looking at the item outside the context of the List, because items may be accessed directly outside the list by RESTful means, or after a document is processed. For example, a List with a code that means "refuted conditions" can not have items that are Condition resources that do not have a [Condition.clinicalStatus](file:///C:\temp\condition.html) of [refuted](file:///C:\temp\valueset-condition-clinical.html#refuted).

**Boundaries and Relationships**

There are five mechanisms in FHIR for communicating collections of resources:

* This List resource - enumerates a flat collection of resources and provides features for managing the collection. While a particular List instance may represent a "snapshot", from a business process perspective the notion of "List" is dynamic â€“ items are added and removed over time. The list resource references other resources. Lists may be curated and have specific business meaning.
* The [Group](file:///C:\temp\group.html) resource - defines a group of specific people, animals, devices, etc. by enumerating them, or by describing qualities that group members have. The group resource refers to other resources, possibly implicitly. Groups are intended to be acted upon or observed as a whole; e.g., performing therapy on a group, calculating risk for a group, etc. This resource will commonly be used for public health (e.g., describing an at-risk population), clinical trials (e.g., defining a test subject pool) and similar purposes.
* The [Composition](file:///C:\temp\composition.html) resource - defines a set of healthcare-related information that is assembled together into a single logical document that provides a single coherent statement of meaning, establishes its own context and that has clinical attestation with regard to who is making the statement. The composition resource provides the basic structure of a FHIR [document](file:///C:\temp\documents.html). The full content of the document is expressed using a bundle. Compositions will often reference Lists as the focus of particular sections.
* The [Bundle](file:///C:\temp\bundle.html) resource - is an infrastructure container for a group of resources. It does not have narrative and is used to group collections of resources for transmission, persistence or processing (e.g. messages, documents, transactions, query responses, etc.) The content of bundles is typically algorithmically determined for a particular exchange or persistence purpose.
* The [DomainResource](file:///C:\temp\domainresource.html).contained element - allows multiple resources to be nested inside any DomainResource. This is a special type of grouping where the grouped resources lose independent existence - they no longer have their own identifiers, can't easily be queried independently, etc. Use of this grouping is a technical mechanism for managing the independence of resources and has no impact on meaning. Contained, bundles and remotely referenced resources convey the same meaning.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\list\list-notes.xml**

**Querying Lists vs. the underlying resources**

When a client system is interested in a patient's medications, allergies, problems, family history or other information typically handled via **List**, they have three options:

* They can query for List instances of the appropriate type; or
* They can query against the resource endpoint for the resources that make up the list (e.g. [AllergyIntolerance](file:///C:\temp\allergyintolerance.html), [Condition](file:///C:\temp\condition.html) [MedicationStatement](file:///C:\temp\medicationstatement.html), etc.), possibly filtering by time, etc.
* They can query against the resource endpoint, requesting one of the [Current](http://build.fhir.org/lifecycle.html#current) resource lists

Querying directly against the clinical resource endpoints will provide an un-curated view of information. A server may contain records that were part of various clinical documents, referrals and other submission sources that may not necessarily be considered wholly accurate or current, but which must be retained "as is" to provide a record of what data was received or seen by a clinician at a particular point in time.

On the other hand, lists are almost always curated. They will include only those records deemed by the author of the list to be both current and accurate. This can be both an advantage and a disadvantage. Lists are less likely to include irrelevant content, but there's the risk that they won't be completely up-to-date (new content may have been added that's more recent than when a given list was last updated. It's also possible that the list author's notion of "current" or "relevant" may differ the perspective of the user performing the query. Also, there's the challenge that multiple lists may exist, with different author and different perspectives

The [Current](http://build.fhir.org/lifecycle.html#current) resource lists get around the problem of multiple lists and make it clear which list is considered authoritative, but not all systems will necessarily support this capability, and there's still the possibility that the list won't be completely up-to-date or will exclude information that is of interest to the querying system.

There's no right and wrong way to retrieve allergy, medication and other such information. Sometimes retrieving the "current" medication list will provide the best results, sometimes querying the raw records will provide better results. Sometimes providing the contents of the list plus a filtered view of the raw records may give the most useful information. What approach is most appropriate will depend on the needs of the user as well as the types of data sources for information in the server and patterns of list maintenance. Client systems may well need to adapt their behavior in different environments if they can't count on consistent server behavior.

**List Order**

All lists are considered ordered - the order in which items literally appear in the list may be an important part of the meaning of the list. Reordering the items in a list may change the meaning of the list.

While a list always contains an ordered set of items, the significance of the order may be unknown, or it may be insignificant. As an example, consider a list of patients for a practitioner to visit. The list may be in order, where the patients are to be visited in the stated order, or just an unsorted list of patients to be visited in any order.

The list resource has a property orderedBy that, if present, specifies the meaning of the item order. Note, though, that the meaning of the order may be known implicitly rather than specified in the orderedBy element.

Applications SHOULD NOT reorder the elements in a list unless they understand the impact of this on the meaning of the list.

**List Mode & Item Deleted**

There are several different kinds of uses for a List resource:

[%codelist http://hl7.org/fhir/list-mode%]

The most common mode is "snapshot" - a list that is accurate within the context it is used in but not current or maintained after that; e.g., medications on discharge in a discharge summary. Note that these lists usually have a status of 'current' - they were current when they were prepared. Some kinds of lists may be explicitly retired (particularly if mode = working), but most will not be maintained after creation.

A change list may include deleted items. Some examples of change lists are a reconciled list of allergies, a discharge medication list and a list with new, updated and deleted items in it - though these may not be lists that include changes (this is an implementation decision). In order to ensure that the list is safe to process, any item where the flag implies that the item has actually been deleted SHALL have the deleted element set to true.

Note that there is no implication about the status of a resource that has been deleted. The only statement that is made is that the resource has been dropped from the list. However applications should ensure that the implication of adding or deleting items from the list is consistent with the logical status of the resource and its contents.

A proper use of List.mode = "changes" with a deleted resource is in a medications list for a discharge summary. See Example "med-list". An improper use would be if the list was a working list of patient medications in a clinical tracking system, and list item flags were used to implement version tracking history within the resource.

**Narrative Content**

The narrative portion of the List resource should contain a summary of the items in the list, their key information, along with a human-readable summary of their flags (if present). The narrative may be generated from the data content and/or narrative of the resources referred to in the list, or it may be a narrative written by a human, which is partially or completely matched by structured data in the linked resources. The human written narrative may be the only content if the list has no entries (which would equate to a narrative only section in a document).

An HTML table is the recommended approach, though this is not required. Each List.item should appear in the narrative for the resource; i.e. it SHALL NOT be necessary to retrieve the list items in order to have a human-readable rendering of the content. In addition, if the List.text.status is "generated", then the narrative should not suggest the list contains items for which there are no corresponding List.item elements. If the list has flags, the representation should make clear use of visual hints (borders, lines, bullet marks, etc.) to ensure that human readers do not get confused about which flags belong with which item on space-poor displays (e.g. to prevent wrapping from separating the flags from the items).

Note that when a List resource is used in a [Document](file:///C:\temp\documents.html), the narrative of the list is part of the attested content of the document.

In a dynamic environment, the narrative content of the list will be limited to the version of the linked resources at the time the list was last updated. It may be even earlier if the narrative isn't updated to reflect the most recent version of all referenced resources at each update. Best practice for 'working' lists is to update the narrative to reflect the most recent content of all list elements each time the list is revised. Lists should therefore not be relied on as a real-time view of the referenced content. There are a few possible approaches to work around this issue:

* Provide minimal information about the listed resources, possibly limited to only a link. (Not recommended as this severely limits the usefulness of the narrative and is particularly problematic for things like documents where the only attested content might be the List narrative)
* Include only "generated" narrative, so the retriever can easily generate their own "current" view of the list by retrieving the referenced resources, ignoring the fixed narrative.
* The server hosting the list can subscribe to all referenced resources and auto-update the narrative each time one of the referenced resources changes (or at least on a semi-frequent basis)

**Empty Reason**

If the list is empty, there could be several different reasons why this is so. For example:

* There are no appropriate entries for the list (i.e. the patient has no known medications/allergies/history)
* The sender (human or system) deemed that these were not related to this context of patient care (usually for privacy related reasons)
* The source system doesn't support these type of entries
* The information to populate the list wasn't gathered - i.e. "Not asked"

Given these possibilities, and the common and significant first case, source systems SHOULD provide an empty reason if the list is empty for many kinds of lists. Because of the importance of this case, the [special value "nil-known"](file:///C:\temp\valueset-list-empty-reason.html) should be used when there are no (significant) entries in this context of care. Note that this concept is sometimes described differently, such as "patient denies taking medications", or "patient was unable to identify any relevant medical history".

When receiving a list, systems should not assume that the list is complete (some entries may have been withheld for a variety of reasons), unless there are specific trading partner arrangements in place or, if the list is empty, that there are actually nil known, unless the "nil-known" code is present.

If the list is empty, the narrative should contain text equivalent to the empty reason.

Note that ther are many kinds of lists that can be just empty with no need for any empty reason ([example](file:///C:\temp\list-example-simple-empty.html))

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\media\media-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\media\media-introduction.xml**

**Scope and Usage**

The Media resource contains photos, videos, and audio recordings. It is used with media acquired or used as part of the healthcare process. Here are some typical usages:

* Photos and videos of diagnostic or care provision procedures for recording purposes
* Images on diagnostic reports

**Boundaries and Relationships**

This resource captures a specific type of Observation - an [Observation](file:///C:\temp\observation.html) whose value is audio, video or image data. This resource is the preferred representation of such forms of information as it exposes the metadata relevant for interpreting the information. However, in some legacy environments, media information may occasionally appear in Observation instead. Systems should be aware of this possibility.

The Media resource is able to contain medical images in a DICOM format. These images may also be made accessible through an [ImagingStudy](file:///C:\temp\imagingstudy.html) resource, which provides a direct reference to the image to a [WADO-RS server](ftp://medical.nema.org/medical/dicom/final/sup161_ft.pdf).

For such images, the WADO-RS framework is a preferred method for representing the images - the WADO-RS service may include rendering the image with annotations and display parameters from an associated DICOM presentation state, for instance.

On the other hand, the media resource allows for a robust transfer of an image across boundaries where the WADO-RS service is not available. For this reason, medical images can also be represented in a Media resource, but the Media.content.url should provide a reference to a source WADO-RS service for the image.

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**Implementation Notes**

The media resource contains several date/times:

* Media.occurence[x] - The date(/time) of collection, or the period over which collection occured
* Media.duration - The duration of the media. The duration might differ from occurencePeriod if recording was paused
* [Media.content.creation](file:///C:\temp\datatypes-definitions.html#Attachment.creation) - This should be consistent with the Media.occurence[x] but might be different due to partial / edited recordings

This resource can embed the image information directly through the attachment.data element. However, good practice is generally to use attachment.url to point to a Binary resource. Servers will frequently be able to persist Binaries in purpose-dedicated repositories more suitable to potentially large artifacts.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\namingsystem\namingsystem-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\namingsystem\namingsystem-introduction.xml**

**Scope and Usage**

Defines a specific code system or identifier system, so that it can be noted in a registry for other systems to find and understand the identifier.

**Boundaries and Relationships**

The CodeSystem resource defines the content of a code system, and also it's preferred identifier. The NamingSystem resource identifies the existence of a code or identifier system, and its possible and preferred identifiers. The key difference between the resources is who creates and manages them - CodeSystem resources are managed by the owner of the code system resource, who can properly define the features and content of the code system. NamingSystem resources, on the other hand, are frequently defined by 3rd parties that encounter the code system in use, and need to describe the use, but do not have the authority to define the features and content. Additionally, there may be multiple authoritative NamingSystem resources for a code systemn, but there should only be one CodeSystem resource.

**Background and Context**

For discussion of policy for creating well maintained OIDs and URIs for resources, see [The HL7 WIKI](http://wiki.hl7.org/index.php?title=InM_FHIR_homepage).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\namingsystem\namingsystem-notes.xml**

**Dealing with duplicate entries**

In some cases, the same code or identifier system might accidentally get created more than once in a registry (perhaps because someone failed to check for an existing entry before adding a new one or knows the same concept with a different name. If this occurs, one of the system entries should be deleted and the remaining entry should have its information updated to include any identifiers present on the original entry (and possibly have its descriptive information modified to include additional information gleaned from the duplicate entry).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationdefinition\operationdefinition-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationdefinition\operationdefinition-introduction.xml**

**Scope and Usage**

The OperationDefinition resource provides a formal computable definition of an [operation](file:///C:\temp\operations.html) or [a named query](file:///C:\temp\search.html#advanced). The OperationDefinition serves two principal purposes:

* To allow for automatic determination of system compatibility
* To allow for dynamic generation of forms to drive the operations

See below for further information about these, and about how Operations and Named Queries are executed.

**Boundaries and Relationships**

Operation Definitions are published to define operations that servers can implement in a common fashion. The FHIR specification itself describes a number (see below), and other organizations, including IHE, national programs, jurisdictions and vendors are able to publish additional operation definitions.

OperationDefinition resources are referred to from two different places:

* From a [Capability Statement](file:///C:\temp\capabilitystatement.html), to declare what operations a system does or should implement
* From another OperationDefinition resource. This allows for a server to describe a limited implementation of a standard operation, or to allow traceability if the server has to rename the operation due to a name clash

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationdefinition\operationdefinition-notes.xml**

**Operations defined as part of this Specification**

<%operationslist%>

**Executing Operations and Named Queries**

Operations are executed by POSTing to a URL that is [defined by the operation definition](file:///C:\temp\operations.html). Named Queries are executed by performing a [search](file:///C:\temp\search.html) with the value of the search parameter "\_query" set to the name provided in the definition.

If the named query is to be performed over the RESTful API, all the parameters must be simple search parameters, so that they can be represented directly in the URL without tricky encoding issues. Named queries always return a bundle containing a set of resources, so all the out parameters must be resources, not data types etc.

**Passing Resources to Operations**

There are two ways to pass resources to an operation - directly, or by reference. Since the two forms have very different behaviors and consequences, the definition of an Operation distinguishes between these two.

As an example, take the [Questionnaire.$populate operation](file:///C:\temp\questionnaire-operations.html#populate). This operation takes a questionnaire as a direct parameter. The type of the parameter is defined as 'Questionnaire'. In a parameters resource, it would be represented like this:

<parameter>

<name value="questionnaire"/>

<resource>

<Questionnaire>

<!-- Questionnaire contents -->

</Questionnaire>

</resource>

</parameter>

or, in JSON:

"parameter": [

{

"name": "questionnaire",

"resource": {

"resourceType": "Questionnaire",

// Questionnaire contents

}

}

]

Other parameters are passed by reference. For example, populate takes a set of references to other resources that should be used to pre-populate the questionnaire. These are passed by reference, and the type of the parameter is 'Reference(Any)' - a reference to any kind of resource. In a parameters resource, it would be represented like this:

<parameter>

<name value="content"/>

<valueReference>

<reference value="Patient/123">

</Questionnaire>

</valueReference>

</parameter>

or, in JSON:

"parameter": [

{

"name": "questionnaire",

"valueReference" : {

"reference" : "Patient/123"

}

}

]

Some operations can take either form; in that case, two different parameters must be defined, one for a resource directly, and one for a reference.

**Renaming OperationDefinition.name**

It's possible for two different organizations to create different operation definitions that have the same name (or, perhaps more likely, to define equivalent operations that have the same name but incompatible approaches in their parameter lists).

It's also possible, though unlikely, that a server will be required to support both of these operations. Should this be the case, the server is able to do this by giving one of them a new name, and then referring to it by definition in the capability statement. To illustrate this, let's assume that two different organizations (orgA and orgB) both define an operation called "dothis", and the definitions are incompatible. OrgA publishes its operation definition at http://orga.com/fhir/dothis.xml, and OrgB publishes its operation at http://fhir.orgb.com/meta/OperationDefinition/dothis. The server is able to implement both. Its capability statement will say:

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

<!-- snip -->

<rest>

<!-- snip -->

<operation>

<name value="dothis"/>

<definition>

<reference value="http://orga.com/fhir/dothis.xml"/>

</definition>

</operation>

<operation>

<name value="dothis2"/>

<definition>

<reference value="http://fhir.orgb.com/meta/OperationDefinition/dothis"/>

</definition>

</operation>

<!-- snip -->

</rest>

<!-- snip -->

</CapabilityStatement>

If a general purpose cross server client is looking for the implementation of the http://fhir.orgb.com/meta/OperationDefinition/dothis operation, and wants to be robust against this name clash problem, instead of simply executing the $dothis operation, it can look at the server's capability statement for the underlying definition URI, and then execute the name given in the capability statement.

**Determining System Compatibility**

A client can determine the compatibility of the server by iterating its capability statement and seeing whether any of the operations it declares to support source from the same definitions as those the client depends on, and whether the server supports the parameters it uses. A client that does this can report a useful error to the user rather than allowing mystifying operational errors to occur.

Note, however, that there are fundamental limitations to this approach because there are many aspects of these operations that aren't (and can't be) defined in a formal fashion. (For example, co-occurrence constraints amongst parameters.)

In the same sense, a 3rd party tool can examine the capability statements from a server and a client definition of an acceptable server and confirm whether those two system are would be unable to interoperate.

**Dynamically Generating Forms**

Finally, it is possible to generate user interface forms automatically from the operation definitions. The documentation in the form definition and the parameter documentation should be sufficiently useful to allow moderately technical users to guess at the correct content of the form. For this reason, highly technical documentation should go in OperationDefinition.notes.

Note also this is not expected to be a tool of use to typical healthcare end-users; such users will usually need more support than can be offered in a generated form.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationoutcome\operationoutcome-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationoutcome\operationoutcome-introduction.xml**

**Scope and Usage**

Operation Outcomes are sets of error, warning and information messages that provide detailed information about the outcome of some attempted system operation. They are provided as a direct system response, or component of one, where they provide information about the outcome of the operation.

OperationOutcomes are used in the following circumstances:

* When an [RESTful operation](file:///C:\temp\http.html#operations) fails
* As the response on a [validation operation](file:///C:\temp\http.html#validate), to provide information about the outcomes
* As part of a message response, usually when the message has not been processed correctly

**Boundaries and Relationships**

This resource is not used for reporting clinical or workflow issues associated with a proposed or ongoing action; these would be handled using [DetectedIssue](file:///C:\temp\detectedissue.html) or other resources. The resource is not designed to be persisted or referenced from other parts of the workflow.

It is possible to have both OperationOutcome and [DetectedIssue](file:///C:\temp\detectedissue.html) together, where the OperationOutcome might indicate that a requested action was rejected due to a clinical issue and the DetectedIssue provides the details of the issue.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\operationoutcome\operationoutcome-notes.xml**

**Using Operation Outcome Resources**

On the RESTful interface, operation outcome resources are only relevant when a level of computable detail is required that is more granular than that provided by the HTTP response codes. This granularity could include:

* more detail about the location of an issue
* the ability to identify multiple distinct issues
* provision of finer error codes that connect to known business failure states

Operation outcomes returned SHOULD be in alignment with the HTTP response code. For example, if the HTTP code indicates a failure (300+), at least one of the issues should have a severity of "error", indicating the reason for the failure.

**Using the Location Element**

Each issue in an operation outcome may have a location reported. Systems that create operation outcomes SHOULD populate the location of an error. A correctly propulated location can allow client systems to:

* Connect return errors with the appropriate UI widget
* Route errors to the corect application or system log
* Develop more intelligent testing applications

In order to support these kinds of usages, this applications need to use the location element consistently. Applications can use the location element to refer to a location inside a resource, or some location in the HTTP request (when appropriate).

**Reporting Errors in Resources**

While resources may be represented in XML, JSON, or other forms, error locations are always reported using a simplified XPath notation:

<location value="/f:Patient/f:identifier"/>

The XPath must use the [FHIR standard XPath prefixes f: and h:](file:///C:\temp\elementdefinition-definitions.html#ElementDefinition.constraint.xpath) for the FHIR and XHTML namespaces respectively.

The XPath here can be used to automatically find the relevant XML element in a resource if the resource is represented in XML. Because resources are often represented in JSON, and because applications will often process the XPath directly (e.g. to determine the relevant widget), the XPath statement must be simple. Specifically, the XPath SHALL only contain element names and repetition indicators. So this is legal:

<location value="/f:Patient/f:identifier[2]/f:label"/>

but this is not:

<location value="/f:Patient/f:identifier[f:system/@value='http://example.com/mrn']/f:label"/>

Because the Xpath is required to be simple, it can be converted to [JsonPointer](https://tools.ietf.org/html/rfc6901) by dropping the namespace prefixes, and correcting for array offsets. The XPaths above have these equivalent JsonPointer representations:

Patient/identifier

Patient/identifier/2/label

Note that correcting for array offsets may require knowledge of which elements are Arrays in JSON. It is also possible to convert the XPath statements to JsonPath, though there is no single standard for JsonPath.

**Reporting Errors in the HTTP Headers**

Servers may also need to report errors in the HTTP headers - especially query parameters when processing searches. Errors are reported using a case sensitive location that has two parts, a fixed "http" and the header or query parameter name separated by a ".". Some examples:

|  |  |
| --- | --- |
| **Location** | **Description** |
| http.name:exact | A reference to the search parameter "name" with the modifier ":exact" |
| http.Authorization | A reference to the Authorization header - perhaps to indicate that it is missing, and some form of authentication is required. |

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\parameters\parameters-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\parameters\parameters-introduction.xml**

**Scope and Usage**

This special resource type is used to represent the [operation](file:///C:\temp\operations.html) request and response.

**Boundaries and Relationships**

This special resource has no other use than for operation parameters, and there is no RESTful end-point associated with it. For further information, see the [operations](file:///C:\temp\operations.html) page.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\parameters\parameters-notes.xml**

Note: for technical compatibility reasons, the *Parameters* resource inherits from [Resource](file:///C:\temp\resource.html), but since the parameter exchange format has no end-point and/or persistence, it never has an id, a versionId, or a lastUpdated. The other features of Resource (tags, profiles, security labels, language etc.) may have use when operations are executed.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\resource\resource-introduction.xml**

ï»¿

**Scope and Usage**

This specification defines a series of different types of resource that can be used to exchange and/or store data in order to solve a wide range of healthcare related problems, both clinical and administrative. In addition, this specification defines several different ways of exchanging the resources.

A resource is an entity that:

* has a known identity (a url) by which it can be addressed
* identifies itself as one of the types of resource defined in this specification
* contains a set of structured data items as described by the definition of the resource type
* has an identified version that changes if the contents of the resource change

Resources have [multiple representations](file:///C:\temp\formats.html).

**Boundaries and Relationships**

The following optional elements and properties are defined for all resources:

* An identity
* Meta data
* A base language
* A reference to "Implicit Rules"

Most resources are derived from [Domain Resources](file:///C:\temp\domainresource.html) - so they also can contain text, contained resources, extensions, and data elements specific to the particular domain of the resource. There is a special type of resource called [Bundle](file:///C:\temp\bundle.html) for collections of resources.

Note: there is documentation for the [Structure](file:///C:\temp\formats.html), [UML](file:///C:\temp\formats.html#uml), [XML](file:///C:\temp\xml.html), and [JSON](file:///C:\temp\json.html) representations of the resource structure.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\resource\resource-notes.xml**

**Resource Identity**

Each resource has an "id" element which contains the logical identity of the resource assigned by the server responsible for storing it. Resources always have a known identity except for the special case when a new resource is being sent to a server to assign an identity ([create interaction](file:///C:\temp\http.html#create)). The logical identity is unique within the space of all resources of the same type on the same server. Once assigned, the identity is never changed. Note that if the resource is copied to another server, the copy might not be able to retain the same logical identity.

The unique identifier of a resource instance is an absolute URI constructed from the server base address at which the instance is found, the resource type and the Logical ID, such as http://test.fhir.org/rest/Patient/123 (where 123 is the Logical Id). When the literal identity is an HTTP address, this address can generally be used to retrieve or manipulate the resource. Note that implementations SHOULD NOT assume that the identity of a resource is always resolvable to a literal server - it may be temporarily unavailable, or not available by policy (e.g. firewalls) or in some cases, it may not actually exist (e.g. use of resource outside a RESTful environment). Resources reference each other by their identity. These references are allowed to be absolute or relative (see [Resource References](file:///C:\temp\references.html) for further discussion). Copying or moving resources from one server to another means that resources acquire a new identity. For further details, see [Managing Resource Identity](file:///C:\temp\managing.html).

Logical ids (and therefore literal identities) are case sensitive. Logical Ids are always opaque, and external systems need not and should not attempt to determine their internal structure. A logical id SHALL always be represented in the same way in resource references and URLs. Ids can be up to 64 characters long, and contain any combination of upper and lowercase ASCII letters, numerals, "-" and ".".

**"Business" Identifiers**

In addition to the logical id and literal identity discussed above, many resources contain an element named "identifier", which, if populated, contains a different kind of identifier. As resources are copied from server to server, their literal identity will change, and their logical id may change.

However, all copies of the resource refer to the same underlying concept, and this concept may also be represented in other formats (variously, [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185), [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7), XDS, and many more). Each representation carries the same identifier that identifies it consistently across all contexts of use. This is known as the business identifier, and is found in the *identifier* element. In a few resources, there is a *url* element that serves a similar purpose, but is constrained to be a literal URL for implementation reasons.

All resources that have an identifier element support searching by the identifier, so that records can be located by that method. So if an [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) message has the following OBR:

OBR|1|845439^GHH OE|1045813^GHH LAB|1554-5^GLUCOSE^LN|||200202150730|...

Then the DiagnosticReport it represents can be located using the following query:

GET [base]/DiagnosticReport?identifier=1045813

If a FHIR server is a stable server that is the canonical master source for the definition of a concept, the business identifier for all systems may be the same as the literal identity of the resource on the master server.

**Resource Metadata**

Each resource contains an element "meta", of type "Meta", which is a set of metadata that provides technical and workflow context to the resource. The metadata items are all optional, though some or all of them may be required in particular implementations or contexts of use.

|  |  |  |
| --- | --- | --- |
| **Metadata Item** | **Type** | **Usage** |
| versionId (0..1) | [id](file:///C:\temp\datatypes.html#id) | Changes each time the content of the resource changes. Can be referenced in a [resource reference](file:///C:\temp\references.html#Resource). Can be used to ensure that updates are based on the latest version of the resource.  The version can be globally unique, or scoped by the Logical Id of the resource. Version identifiers are generally either a serially incrementing id scoped by the logical id, or a uuid, though neither of these approaches is required. There is no fixed order for version ids - clients cannot assume that a versionId that comes after another one either numerically or alphabetically represents a later version. The same versionId can never be used for more than one version of the same resource.  Note that servers SHOULD support versions, but some are unable to |
| lastUpdated (0..1) | [instant](file:///C:\temp\datatypes.html#instant) | If populated, this value changes each time the content of the resource changes. it can be used by a system or a human to judge the currency of the resource content. Note that [version aware updates](file:///C:\temp\http.html#update) do not use this element |
| profile (0..\*) | [uri](file:///C:\temp\datatypes.html#uri) | An assertion that the content conforms to a resource profile (a [StructureDefinition](file:///C:\temp\structuredefinition.html)). See [Extending and Restricting Resources](file:///C:\temp\profiling.html#resources) for further discussion. Can be changed as profiles and value sets change or the system rechecks conformance |
| security (0..\*) | [Coding](file:///C:\temp\datatypes.html#Coding) | [Security labels](file:///C:\temp\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 |
| tag (0..\*) | [Coding](file:///C:\temp\datatypes.html#Coding) | [Tags](file:///C:\temp\resource-definitions.html#Meta.tag) 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. |

[%edt Meta resource.html 1%]

Note that the RESTful API defines some [Operations](file:///C:\temp\operations.html) that provide [direct read and write access](file:///C:\temp\resource-operations.html#meta) to the *meta* element.

**Technical vs Business Versions**

All resources are conceptually versioned, and each resource sits at the head of a linear list of past versions. The past versions are superseded by the current version, and only available for audit/integrity purposes. The current version is e.g. http://acme.org/fhir/ResourceType/id123, and a past version would be http://acme.org/fhir/ResourceType/id123/\_history/v2.

Note that there's no requirement for servers to keep a history. The [history interaction](file:///C:\temp\http.html#history) is provided for where this is an appropriate service to provide. However, whether a server keeps them or not, past versions are dead and gone. The current version of the resource is in the *Resource.meta.versionId*. For a value set this would be:

<ValueSet>

<meta>

<versionId value="v2"/>

</meta>

</ValueSet>

That version changes every time the server updates the resource and writes a new version over the top of an existing one.

Some resources have another version marker in them. For instance, ValueSet has another version in it:

<ValueSet>

<url value="http://acme.com/fhir/ValueSet/example"/>

<version value="2.0"/>

</ValueSet>

This says that this is version 2.0 of the 'example' value set. This is the business version of the value set, the one that humans get involved with. These 2 versions elements have quite different lifecycles. To illustrate, take these cases:

1. A value set is posted to a server (POST [base]/ValueSet) with ValueSet.url = "http://acme.com/valuesets/example". This is identified as the 1st version of the value set (ValueSet.version = 1). When the server gets it, it assigns an identity e.g. ValueSet.id = x1, and ValueSet.meta.versionId = 1. Later, another user creates a revised version of the value set, and this is called version 2. It is committed to the server as an update (PUT [base]/ValueSet/x1).   
   Now, ValueSet.url = http://acme.com/valuesets/example, ValueSet.id = x1, ValueSet.version = 2 and ValueSet.meta.versionId = 2
2. A value set is posted to a server (POST [base]/ValueSet) with ValueSet.url = "http://acme.com/valuesets/example". This is identified as the 1st version of the value set (ValueSet.version = 1). When the server gets it, it assigns an identity e.g. ValueSet.id = x1, and ValueSet.meta.versionId = 1. Then a typo is found in the definition, so this is fixed, but it's still v1 of the value set. This is PUT to [base]/ValueSet/x1. Now, ValueSet.url = http://acme.com/valuesets/example, ValueSet.id = x1, ValueSet.version = 1 and ValueSet.meta.versionId = 2.   
   Later, another user creates a revised version of the value set, and this is called version 2. It is commmited to the server as an update (PUT [base]/ValueSet/x1). Now, ValueSet.url = http://acme.com/valuesets/example, ValueSet.id = x1, ValueSet.version = 2 and ValueSet.meta.versionId = 3
3. A value set is posted to a server (POST [base]/ValueSet) with ValueSet.url = "http://acme.com/valuesets/example". This is identified as the 1st version of the value set (ValueSet.version = 1). When the server gets it, it assigns an identity e.g. ValueSet.id = x1, and ValueSet.meta.versionId = 1. Later, another user creates a revised version of the value set, and this is called version 2. This time, as well as supporting this new version 2, there are production systems still using version 1, and both need to be valid on the value set server. So a new value set is created on the server (POST [base]/ValueSet) and is assigned the identiity 'x2'.   
   Now, there are two different value sets, both with URL "http://acme.com/valuesets/example". One has ValueSet.id = x1, ValueSet.version = 1 and ValueSet.meta.versionId = 1 and the other has ValueSet.id = x2, ValueSet.version = 2 and ValueSet.meta.versionId = 1.

**Implicit Rules**

A reference to a custom agreement that describes how the resource is being used (e.g. an [implementation guide](file:///C:\temp\profiling.html#glossary)) that was followed when the resource was constructed, where the implemenation guide must be known and understood in order to safely processing the content.

Asserting this rule set restricts the content to be only understood by a limited set of trading partners. This inherently limits the usefulness of the data in the long term, and should be avoided where possible. However, the existing health eco-system is highly fractured, and not yet ready to define, collect, and exchange data in a generally exchangeable sense.

Note that resources are almost always constructed following some custom agreement. Best practice - which is recommended through out the conformance resources - is that such agreements make all knowledge about the content of the resource explicit in the content of the resource (e.g. no default values in profiles); if custom agreements follow this advice, and declare their extensions as required, then it is not necessary to understand the agreement in order to safely process the resource content. For this reason, use of implicitRules is rare.

**Language**

Each resource may have a language element that specifies the base language of the content using a [code defined in BCP 47](http://tools.ietf.org/html/bcp47). The language element is provided to support indexing and accessibility (e.g. text-to-speech use the language tag).

There is no default language, though one may be inferred from the context of use. Not all of the content of the resource has to be in the specified language.

If a language is specified, it should also be specified on the [Narrative Text](file:///C:\temp\narrative.html#Narrative). The html language tag in the narrative is used when processing the narrative. The language tag on the resource is provided so that applications processing the data in the resource can specify the language of any alternate presentations generated from the data.

**Tags, Profiles, and Security Labels**

These 3 metadata attributes are part of the resource, but are never used to keep information that needs to be understood when interpreting the content of a resource; their function is limited to finding and controlling access to the resource, and connecting resources to technical or clinical workflow.

**Tags**

Tags are used to associate additional operational information with the Resources, including such as workflow management. A typical use of tagging would be to maintain an informal list of resources that need review.

In a general tag, the [coded concept](file:///C:\temp\datatypes.html#coding) may be a reference to a healthcare vocabulary, including ones defined in this specification, or vocabularies such as those defined by HL7 for other purposes (e.g. [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) and [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186)/[CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7)), LOINC, or SNOMED CT. Alternatively, the concept may be one defined by the implementation in the local context.

The list of tags on a resource is a set, where each tag is unique based on the system+code combination.

**Profile Tags**

A profile assertion represents a claim that the resource conforms to [the identified StructureDefinition](file:///C:\temp\structuredefinition.html), which makes rules about what content is allowed to be in a resource. In a profile tag, the term is a URL that references an identified [StructureDefinition](file:///C:\temp\structuredefinition.html) resource.

It's always possible to determine whether a resource conforms to any profile simply by testing it against the profile (the [validation tools](file:///C:\temp\downloads.html) provide the functionality to perform this test in a variety of contexts). However there are several circumstances where simply examining whether a resource conforms to a particular profile as needed is impractical:

* A server searching a set of resources for ones that conform to a particular profile
* A receiver that has many profiles to choose when validating resource

Profile Tags serve these use cases - a client/creator of a resource can tag the resource with an assertion that the resource conforms to a particular structure definition. The server/receiver of the resource can choose to take this assertion at face value, or to assist in locating the correct [StructureDefinition](file:///C:\temp\structuredefinition.html) against which to validate the resource.

Note: resources can conform to multiple profiles at once. A resource can conform to a profile without ever being labeled that it does, or a resource may falsely claim to conform to a profile. For this reason, applications processing resources SHOULD always depend on the contents of the resource when processing them, and/or check resources against the [StructureDefinition](file:///C:\temp\structuredefinition.html)s directly rather than relying the existence of profile tags for meaning. Profile Tags are provided as a method of finding resources that conform to a particular [StructureDefinition](file:///C:\temp\structuredefinition.html), not statements of meaning about the resource.

Many trading partner agreements will make rules about what claims can be made and when they must be tested, which will make the profile assertion more reliable.

The list of profiles on a resource is a set, where each profile is unique based on the value of the URI.

**Security Labels**

A security label is attached to a resource to provide specific security metadata about the information in the resource. For further information, see [Security Labels](file:///C:\temp\security-labels.html).

The list of security on a resource is a set, where each tag is unique based on the system+code combination.

**Updates to Tags, Profiles, and Security Labels**

When a resource is updated (e.g. on the RESTful interface), servers generally follow this pattern:

* Merge existing and new tags
* Replace existing profile tags with new profile tags
* Merge existing and new security labels

However, in some cases, an update may invalidate existing tags. Servers may update or remove previously existing recognized tags if this is known to be appropriate.

**Maturity Levels**

All resources in this specification are assigned a "Maturity Level", known as FMM (after the well known [CMM](http://en.wikipedia.org/wiki/Capability_Maturity_Model) grades). The FMM level can be used by implementers to judge how advanced - and therefore stable - a resource is. The following FMM levels are defined:

1. the resource or profile (artifact) has been published on the current build. This level is synonymous with Draft.
2. PLUS the artifact produces no warnings during the build process and the responsible WG has indicated that they consider the artifact substantially complete and ready for implementation
3. PLUS the artifact has been tested and successfully exchanged between at least three independently developed systems leveraging at least 80% of the core data elements using semi-realistic data and scenarios based on at least one of the declared scopes of the resource (e.g. at a connectathon). These interoperability results must have been reported to and accepted by the FMG
4. PLUS the artifact has been verified by the work group as meeting the [STU Quality Guidelines](http://wiki.hl7.org/index.php?title=DSTU_2_QA_guidelines) and has been subject to a round of formal balloting; has at least 10 implementer comments recorded in the tracker drawn from at least 3 organizations resulting in at least one substantive change
5. PLUS the artifact has been tested across its scope (see below), published in a formal publication (e.g. STU), and implemented in multiple prototype projects. As well, the responsible work group agrees the resource is sufficiently stable to require implementer consultation for subsequent non-backward compatible changes.
6. PLUS the artifact has been published in two formal publication release cycles at FMM1+ (i.e. STU level) and has been implemented in at least 5 independent production systems in more than one country

Tested across scope means:

* The FMG has signed off on the list of "example contexts" defined for the artifact
* For each example context, the artifact has either been: reviewed and approved by a domain expert for that scope area, mapped to an existing implemented scope-area-specific standard or tested in an implementation

The Maturity level is strongly related to stability; the higher the maturity level, the more controls are enforced to restrict breaking changes to the resource. For further information, and discussion, see the [FHIR Wiki](http://wiki.hl7.org/index.php?title=FHIR_Maturity_Model).

**Further Information**

* [Conformance Rules](file:///C:\temp\conformance-rules.html)
* [Resource Definitions](file:///C:\temp\resource.html)
* [References between Resources](file:///C:\temp\references.html)
* [Narratives](file:///C:\temp\narrative.html)
* [Formats:](file:///C:\temp\formats.html) [XML](file:///C:\temp\xml.html), [JSON](file:///C:\temp\json.html)
* [Extensibility](file:///C:\temp\extensibility.html) ([Examples](file:///C:\temp\extensibility-examples.html))
* [Detailed Descriptions](file:///C:\temp\resource-definitions.html)
* [Inter-version Compatibility](file:///C:\temp\compatibility.html)

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\searchparameter\searchparameter-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\searchparameter\searchparameter-introduction.xml**

**Scope and Usage**

A SearchParameter resource specifies a search parameter that may be used on the RESTful API to search or filter on a resource. The SearchParameter resource declares:

* how to refer to the search parameter from a client
* how the search parameter is to be understood by the server
* where in the source resource the parameter matches

**Boundaries and Relationships**

* Search Parameters are referred to by [CapabilityStatement](file:///C:\temp\capabilitystatement.html) resources via the canonical URL for a search parameter ([CapabilityStatement.rest.resource.searchParam.definition](file:///C:\temp\capabilitystatement-definitions.html#CapabilityStatement.rest.resource.searchParam.definition))
* Search Parameters can appear in an [Implementation Guide](file:///C:\temp\implementationguide.html) to specify how resources can be found

**Background and Context**

Implementers should be familiar with the background and concepts described in [Search](file:///C:\temp\search.html) on the RESTful API before working with this resource.

There is a [registry of all Search Parameters](file:///C:\temp\searchparameter-registry.html).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\searchparameter\searchparameter-notes.xml**

**SearchParameters on Extensions**

The SearchParameter resource may be used to define searches on extensions. Depending on the context of the extension (as defined in the [StructureDefinition](file:///C:\temp\structuredefinition.html)), this may require multiple instances of the SearchParameter.xpath element like so:

* If the extension's context is scoped by a single resource, SearchParameter.base must be set to that resource, and there may be one or more xpath elements corresponding to the elements specified in the extension's context, e.g. "f:Patient/f:name/f:extension[@url='extension url']"
* If the extension's context specifies multiple resources, SearchParameter.base must be set to "DomainResource".
* You may use a single xpath element with the full url of the Extension to indicate that the SearchParameter would search in all elements of the given SearchParameter.base resource for the given extension.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\structuredefinition\structuredefinition-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\structuredefinition\structuredefinition-introduction.xml**

**Scope and Usage**

The StructureDefinition resource describes a structure - a set of data element definitions, and their associated rules of usage. These structure definitions are used to describe both the content defined in the FHIR specification itself - Resources, data types, the underlying infrastructural types, and also are used to describe how these structures are used in implementations. This allows the definitions of the structures to be shared and published through repositories of structure definitions, compared with each other, and used as the basis for code, report and UI generation.

Note that as part of the specification itself, a [full set of structure definitions](file:///C:\temp\downloads.html#profiles) for all resources and data types is published.

**Boundaries and Relationships**

* StructureDefinitions are used by [CapabilityStatement](file:///C:\temp\capabilitystatement.html) instances for specifying how resources are used
* StructureDefinitions use [Value Sets](file:///C:\temp\valueset.html) to specify the content of coded elements
* StructureDefinitions define concrete elements and structures for use with FHIR alone and that have defined wire representations (XML, JSON, etc.). This is distinct from [DataElement](file:///C:\temp\dataelement.html) which defines abstract elements that might appear anywhere - FHIR, questionnaire questions, [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7),[HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185), X12, OpenEHR, a proprietary database, etc. Data elements may map to FHIR resources, data types and/or extensions but do not have any defined serialization format of their own.

**Background and Context**

Implementers should be familiar with the background and concepts described in [Profiling FHIR](file:///C:\temp\profiling.html) before working with this resource.

**Metadata**

The StructureDefinition resource has a set of metadata that is mostly shared with the [Value Set](file:///C:\temp\valueset.html), [CapabilityStatement](file:///C:\temp\capabilitystatement.html) and other infrastructure resources. The metadata describes the structure, and helps find the structure when registered in profile repositories.

|  |  |
| --- | --- |
| url | The identifier that is used to identify this structure when it is referenced in a specification, model, design or an instance. This URL is where the structure can be accessed |
| identifier | Other identifiers that are used to identify this structure |
| version | The identifier that is used to identify this version of the structure when it is referenced in a specification, model, design or instance. This is an arbitrary value managed by the structure author manually and the value should be a timestamp.  Note that there may be multiple resource versions of the structure that have this same identifier. The resource will have updates that create new versions for technical reasons, whereas the stated version number needs to be under the author's control |
| name | A free text natural language name identifying the structure |
| publisher | Details of the individual or organization who accepts responsibility for publishing the structure. This helps establish the "authority/credibility" of the structure. |
| telecom | Contact details to assist a user in finding and communicating with the publisher |
| description | A free text natural language description of the structure and its use |
| requirements | The Scope and Usage that this structure was created to meet |
| code | A set of terms from external terminologies that may be used to assist with indexing and searching of profiles |
| status | The status of the structure allows filtering of profiles that are appropriate for use vs. not. See the [Status Codes](file:///C:\temp\valueset-publication-status.html) |
| experimental | This structure was authored for testing purposes (or education/evaluation/marketing), and is not intended to be used for genuine usage |
| date | The date this version of the structure was published |
| fhirVersion | The version of the FHIR specification on which this structure is based. It is not necessary to specify the version, as most profiles are valid across multiple versions, and the validity of a structure against a particular version of FHIR can easily be checked by tooling. |
| type | todo |
| contextType | todo |
| context | todo |

Notes:

* The name of the structure is not required to be globally unique, but the name should have some scoping information (e.g. Acme Inc. (USA), Allergy List)
* Multiple codes may be assigned to the structure. These may either describe the structure, the focus of the structure or both. They are solely to help find the structure by searching for structured concepts
* The 3 status codes (draft, active, and retired) are the codes that are relevant to structure consumers. Authors may wish to use the [authoring-status](file:///C:\temp\intros%20and%20notes.html#author-status) extension to track the life cycle of a structure as it is prepared

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\structuredefinition\structuredefinition-notes.xml**

**Interpretation Notes:**

* A structure is represented as a flat list of elements. The element.path provides the overall structure.
* Differentials in constraints need only specify elements that they are making rules about. Other elements can be inferred as defined in the base resource
* Elements specified in the differential (and all elements in the snapshot) must be ordered as such:
  + Elements from the baseDefinition appear before new elements in a specialization profile
  + Elements must be in the same order as the baseDefinition, and child elements appear in depth-first order.
  + Unsliced descendants of sliced elements appear before slices
* element.short, element.formal, element.comments and element.mapping provide the specific definition for the field in a specific context.
* element.type is used to specify which types may be used for this element. If there is more than one type, the element offers a choice of types and must have a name that terminates in "[x]". When profiling a resource, and only one type is specified, the names of element is changed to include the type instead of '[x]'.
* When using xpath to make constraints about the relationship between the contents of the narrative and the contents of the data elements, the element against which the rule is expressed is the one against which the error or warning will be reported by a validator.
* When expression constraints are placed on elements that offer a choice of types, the expression has to select the type to which it applies using the [fluentpath is operator](http://hl7.org/fluentpath/#types).
* For xpath constraints, the prefix "f" should be used for "http://hl7.org/fhir", and "h" for "http://www.w3.org/1999/xhtml". XPath constraints are written against the XML representation
* The condition element is used to assert that a constraint defined on another element affects the allowed cardinality of this element.

**Different uses for StructureDefinition**

The base structure definition is used in a number of different ways to support the FHIR specification. The various uses of the StructureDefinition are controlled by the elements kind, constrainedType, base, and url, using this basic pattern:

{

"url": the identity of this structure definition,

"kind": (datatype | resource),

"type": the type being constrained (if it's a constraint)

"baseDefinition": the structure definition from which this is derived

}

This list shows a number of examples, with links to real examples for each:

1. Base definition of a data type (example: [Quantity](file:///C:\temp\datatypes.html#Quantity) - [XML](file:///C:\temp\quantity.profile.xml.html), [JSON](file:///C:\temp\quantity.profile.json.html)):
2. {
3. "resourceType": "StructureDefinition",
4. "url": "http://hl7.org/fhir/StructureDefinition/Quantity",
5. "name": "Quantity",
6. "kind": "datatype",
7. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/Element"
8. }
9. A constrained data type (example: [Money](file:///C:\temp\datatypes.html#Money) - [XML](file:///C:\temp\money.profile.xml.html), [JSON](file:///C:\temp\money.profile.json.html)):
10. {
11. "resourceType": "StructureDefinition",
12. "url": "http://hl7.org/fhir/StructureDefinition/Money",
13. "name": "Money",
14. "kind": "datatype",
15. "type": "Quantity",
16. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/Quantity"
17. }
18. Base definition of a resource (example: [Patient](file:///C:\temp\patient.html) - [XML](file:///C:\temp\patient.profile.xml.html), [JSON](file:///C:\temp\patient.profile.json.html)):
19. {
20. "resourceType": "StructureDefinition",
21. "url": "http://hl7.org/fhir/StructureDefinition/Patient",
22. "name": "Patient",
23. "kind": "resource",
24. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/DomainResource"
25. }
26. Constraint on a resource (example: [Clinical Document Profile for Composition](file:///C:\temp\clinicaldocument.html) - [XML](file:///C:\temp\clinicaldocument.profile.xml.html), [JSON](file:///C:\temp\clinicaldocument.profile.json.html)):
27. {
28. "resourceType": "StructureDefinition",
29. "url": "http://hl7.org/fhir/StructureDefinition/clinicaldocument",
30. "name": "Clinical Document Profile for Composition",
31. "kind": "resource",
32. "type": "Composition",
33. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/Composition"
34. }
35. Base Extension (a standard data type) (example: [Extension](file:///C:\temp\extensibility.html#Extension) - [XML](file:///C:\temp\extension.profile.xml.html), [JSON](file:///C:\temp\extension.profile.json.html)):
36. {
37. "resourceType": "StructureDefinition",
38. "url": "http://hl7.org/fhir/StructureDefinition/Extension",
39. "name": "Extension",
40. "kind": "datatype",
41. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/Element"
42. }
43. A defined Extension (example: [Extension Data Absent Reason](file:///C:\temp\extension-data-absent-reason.html) - [XML](file:///C:\temp\extension-data-absent-reason.xml.html), [JSON](file:///C:\temp\extension-data-absent-reason.json.html)):
44. {
45. "resourceType": "StructureDefinition",
46. "url": "http://hl7.org/fhir/StructureDefinition/data-absent-reason",
47. "name": "Data Absent Reason",
48. "kind": "complex-type",
49. "type": "Extension",
50. "baseDefinition": "http://hl7.org/fhir/StructureDefinition/Extension"
51. }
52. A constraint on a defined extension (no examples currently defined):
53. {
54. "resourceType": "StructureDefinition",
55. "url": "http://example.org/fhir/StructureDefinition/race",
56. "name": "Race codes used by institution (a subset of meaningful use codes)",
57. "kind": "datatype",
58. "type": "Extension",
59. "baseDefinition": "http://hl7.org/fhir/us/core/StructureDefinition/us-core-race"
60. }

On this list, structure definitions of type 1, 3, and 5 can only be defined by the FHIR specification itself. The other kinds of structure definitions are (or may be) created by the specification, but can also be defined by other implementers.

**Rules for Constrained Types**

When the structure is a constraint (constrainedType is not null), see [Extending and Restricting Resources](file:///C:\temp\profiling.html#resources) for the rules that apply.

**Common Mapping Targets**

Structures are able to map elements to concepts in other definition systems. Generally these are used to map the elements to local implementation models, data paths, and concepts. However they are also used to map to other standards and published terminologies. These are the standard URIs used for common targets of the mapping:

[%mappings-table%]

**Logical Models**

StructureDefinitions are used to define the basic structures of FHIR: data types, resources, extensions, and profiles. The same definition structure can also be used to define any arbitrary structures that are a directed acyclic graph with typed nodes, where the primitive types are those defined by the FHIR specification.

This can be useful when

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ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\structuremap\structuremap-introduction.xml**

**Scope and Usage**

The *StructureMap* resource defines a detailed set of of rules that describe how one [Structure](file:///C:\temp\structuredefinition.html) is related to another, and provides sufficient detail to allow for autoamted conversion of instances.

The intention of the structure map resource is to allow a specialist in a formats and interoperability to specify the full relationships between two structures (e.g. a CDA document and a set of FHIR resources), and then many different systems - both testing and production clinical systems - can leverage that to automatically transform from one format to the other.

Maps are uni-directional: they map from the source structure to the target structure, and no reverse map is implied. Even if the mapping is simple, and loss-less, it cannot be assumed that there are no conditions that might additionally apply in the reverse direction.

The mapping language, along with a concrete syntax, is defined in detail in [the FHIR Mappping Language](file:///C:\temp\mapping-language.html), which defines a concrete syntax for the language. The StructureMap resource represents the abstract syntax, and the concrete syntax is the recommended narrative representation for a StructureMap. See also the [Tutorial](file:///C:\temp\mapping-tutorial.html).

**Boundaries and Relationships**

Note that many mappings between models only establish conceptual equivalence between the structures. These models are useful because they quickly convey how the structures are related to humans, whereas more maps with sufficient detail to support instance transformation are necessarily full of fine detail that can obscure the conceptual relationships. The [ConceptMap](file:///C:\temp\conceptmap.html) resource is suitable for representing high level relationships between models, while this *StructureMap* resource is intended to describe the full details that need to be known in order to transform an instance of data from one structure to another.

The *StructureMap* resource assumes that both the source and the target models are fully defined using [StructureDefinition](file:///C:\temp\structuredefinition.html) resources - either resources, or logical models, and is described accordingly. However there is no direct relationship between the mapping language contained in the StructureMap resource, and the existence of the appropriate structure definitions, so that this mapping language could be used to define a map from an HL7 v2 message to a CDA document. Note, that various implementation contexts may introduce a direct relationship (e.g. see xxxxxxx op to defined).

It's possible to apply the mapping language to structures that do not even have (or cannot have) formally defined types, though of course the type-related parts of the mapping language cannot be used in these cases.

**Background and Context**

Each structure map contains, in addition to the standard metadata that all conformance resoures contain, the following information:

* A list of the structure definitions referenced by the map
* A list of other structure maps that the map uses
* One or more groups of rules that describe how content in the source is transformed to content in the target

Each group of rules defines a set of input and output variables that must be passed when the group is invoked in a particular context. When a gruop is invoked, all the rules in the group are checked to see whether they apply.

Each rule may has some or all of the following properties:

* A name - used as the identity in internal references, and traces
* Contexts in both source and traget models that define where the rule applies
* A set of source elements that provide data to be mapped
* Conditions that specify if the rule is to apply
* A set of target elements that will be created
* Transform rules that describe how raw data is converted from the source format to the target format (e.g. string manipulation)
* Flags for how instances that can repeat are handled
* Additional rules that apply to the newly created elements (e.g. new contexts)

The mapping language is entirely declarative; there is no imperative or procedural aspects to the definitions.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\subscription\subscription-introduction.xml**

**Scope and Usage**

Once a subscription is created, any newly created or updated resources that meet the criteria in the resource cause a notification to be sent using the provided channel. The criteria are [Search](file:///C:\temp\search.html) strings that have the same interpretation as if they were appended to the base URL and submitted using the REST API. Note that the search criteria are applied to the new value of the resource. The consequence of this is that there is no notification when a resource is deleted, or when a resource is updated so that it no longer meets the criteria.

The server is able to send notifications without any information about the matching resource, or with the entire resource.

Several different types of channels are supported:

* **rest-hook**: A post is made to the URL. If the subscription requests that the whole resource is included, the URL is interpreted as the service base
* **websocket**: A PING message is sent to the designated URI
* **email/sms**: A notification is send to nominated email address or SMS number
* **message**: The resource is sent to the application identified in the URI as a [message](file:///C:\temp\messaging.html)

See below for further discussion of the various channels. Note that sending the entire resource creates security concerns that must be managed by the server.

Subscriptions are active resources; a server can only accept a subscription if it will execute the specified channel for any resources subsequently received. The subscription is no longer active once it is deleted from the server.

**Boundaries and Relationships**

As an alternative to subscriptions, the RESTful API describes a polling-based subscription method using [bundles](file:///C:\temp\bundle.html) and the [history operation](file:///C:\temp\http.html#history). This method of polling allows for a much tighter relationship between the client and the server that doesn't involve missing updates and/or deletes.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\subscription\subscription-notes.xml**

**Safety and Security**

Executing each of the channels documented below involves the server sending a communication that will reveal information about the client and server relationship, and, if the entire resource is sent, administrative or clinical information that may be quite sensitive and/or protected under law. Servers are responsible for ensuring appropriate security is employed for each channel. The subscription resource does not address these concerns directly - it is assumed that these are administered by other configuration. For instance, a server might maintain a whitelist of acceptable servers for the rest-create/rest-update methods.

Emails should generally be secured using some technique such as [Direct](http://directproject.org/).

**Managing Subscriptions and Errors**

A subscription is defined by creating the subscription on the server. When the subscription is created by the client, it sets the status to "requested". After POSTing the subscription, the client parses the Location header and saves the new Subscription's logical id for use in subsequent operations.

The criteria are subject to the same limitations as the client that created it, such as access to patient compartments etc. Note that the subscription remains active after the client access tokens expire.

Once the server has activated the subscription, it sets the status to "active" (note: the server can do this as it accepts the resource if it wants).

An appropriately authorized client can use search and/or history operations to see what subscriptions are currently active on the server. Once the subscription is no longer desired, the client deletes the subscription from the server.

The server may retry the notification a fixed number of times and/or refer errors to its own alert logs. If the notification fails, the server should set the status to 'error', and mark the error in the resource. If the notification succeeds, the server should update the status to "active again. If a subscription fails consistently a server may choose set the subscription status to off, and stop trying to send notifications.

If a subscription nominates a fixed end date, the server automatically deletes it at the specified time.

**Channels**

**REST Hook**

This uses an empty POST message to alert the client that new results are available - POST to [base]/Subscription:

{

"resourceType": "Subscription",

"criteria": "Observation?name=http://loinc.org|1975-2&\_format=json",

"channel": {

"type": "rest-hook",

"endpoint": "https://biliwatch.com/customers/mount-auburn-miu/on-result",

"header": "Authorization: Bearer secret-token-abc-123"

}

}

When a resource is created or updated that meets the criteria, the server sends a POST request with no body to the nominated URL.

When the client receives a POST to https://biliwatch.com/customers/mount-auburn-miu/on-result, it re-issues the criteria as a query to the server, appending &\_since=:last (where :last is replaced by the time at which the client last checked). In this way it can fetch all new relevant [Observations](file:///C:\temp\observation.html).

Since payload is missing, the data in the resources is only available through the REST API, which helps consolidate authorization and authentication logic. The server must append the headers, if any are given, to the POST request that it makes to the client.

Alternatively, the server can be asked to send the entire resource to a nominated FHIR end-point. This is usually appropriate for defining routing rules within a managed eco-system such as a healthcare institution.

{

"channel": {

"type": "rest-hook",

"endpoint": "https://internal.acme.com/research/saturn",

"payload": "application/fhir+json"

}

}

This requests that a server forward a copy of any matching resource in json format to the nominated server as an [Update operation](file:///C:\temp\http.html#update) using the nominated URL as the [service base](file:///C:\temp\http.html#root). In order to execute this channel, the server must know how to authenticate appropriately with the destination server. This can be done by the subscription resource providing an authentication header for the server to use, or alternatively, the server may be specifically configured to be able to use the nominated server.

**WebSockets**

Subscriptions are created exclusively via the FHIR REST API. But notifications need not occur via REST. Indeed, some clients may be unable to expose an outward-facing HTTP server to receive triggered notifications. For example, a pure client-side Web app or mobile app may want to subscribe to a data feed without polling using the /history operation. This can be accomplished using a websocket notification channel.

A client can declare its intention to listen via Web Sockets:

{

"channel": {

"type": "websocket"

}

}

The client would then initiate a Web Socket connection to the server, at a URL advertised in the FHIR server's Capability statement (subscriptions/webSocketUrl (todo)). A simple protocol is used to listen for notifications:

* Client connects a secure Web Socket to the servers's webSocketUrl (see [websocket extension](file:///C:\temp\extension-capabilitystatement-websocket.html) in the server's [CapabilityStatement](file:///C:\temp\capabilitystatement.html)).
* Client authenticates to server using a server-specified Web socket protocol (e.g. OAuth bearer token presentation).
* Client sends a bind :id message over the socket (using the logical id of the subscription). For example, the client might issue: bind 123).
* Server responds with a "bound :id" message to acknowledge.
* Server sends a "ping :id" message to notify the client each time a new result is available

**Email/SMS**

A client can register for its user to receive notifications by email:

{

"channel": {

"type": "email",

"endpoint": "mailto:mt-auburn-results@direct.biliwatch.com",

"header": "A new bilirubin result has arrived!"

}

}

The server would send a new message for each matching resource. The body of the email may be empty, or it may contain a reference to the search or the matching resource. It is at the discretion of the server as to how much information to provide. The email should be secured appropriately, such as using Direct, as specified by the rules of the applicable jurisdictions.

SMS works very similarly:

{

"channel": {

"type": "sms",

"endpoint": "tel:+1555-345-5555"

}

}

Note: SMS messages are extremely limited in size, so payload should be set to false Irrespective of size, most servers will refuse to send payloads in SMS for security reasons.

**Messaging**

A client can register for its user to receive notifications by [messaging](file:///C:\temp\messaging.html):

{

"channel": {

"type": "message",

"endpoint": "http://ehr.example.org/fhir/$process-message"

}

}

For each matching resource, a server will send a message to the nominated end-point. Most servers will require that the end-point is white-listed prior to allowing these kinds of subscriptions.

**STU Note:** The details of the message - mainly the event code - are still to be resolved during the trial use period.

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

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\testreport\testreport-introduction.xml**

**Scope and Usage**

The [TestScript](file:///C:\temp\testscript.html) resource is used to define tests that can be executed on one or more FHIR servers. The TestReport resource defines how systems should encode the summarized results of executing a TestScript.

The TestReport structure mirrors the TestScript concepts of having sections for setup, tests, and teardown. If present, these ordered lists should mirror the actions (either operations or assertions) of the referenced TestScript with a result code: pass, skip, fail, warning, or error.

**Background and Context**

**Background**

Implementers should be familiar with the testing concepts and descriptions found in [Testing FHIR](file:///C:\temp\testing.html) before working with this resource.

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**Notes**

Please refer to the [Testing FHIR - How Tos](file:///C:\temp\testing.html#howTos) for examples on working with this resource.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\testscript\testscript-introduction.xml**

**Scope and Usage**

The TestScript resource is used to define tests that can be executed on one or more FHIR servers. The TestScript resource would typically contain

* a list of fixtures (required resources used in the tests)
* setup procedures
* a suite of thematically related tests
* teardown procedures

For example, one TestScript might feature a set of tests focusing on searching Patients and validating the Bundle responses. The fixtures for such a test would contain a list of Patient resources that are required for the test to complete successfully. The setup procedures create the fixtures on the FHIR server being tested. A series of tests execute various search parameters and search for the fixtures in the results. The teardown procedures would then clean up (delete) the fixtures on FHIR server that were created during the setup procedures.

The purpose of the TestScript is to encode in an executable representation tests that can be used to

1. determine whether a given FHIR server adheres to the FHIR specification and
2. determine whether two or more FHIR servers implement capabilities in a compatible or interoperable manner.

It may not be possible to fully automate the latter goal (especially with regards to business rules that might ride on top of different implementations), however the tests should be able to determine whether two servers support the operations, value sets, profiles, and extensions to exchange Bundles of Resources (such as returned from the [Patient $everything operation](file:///C:\temp\operation-patient-everything.html)).

**Boundaries and Relationships**

The TestScript resource should **NOT** be used to represent Clinical tests, Prescriptions, or any other Healthcare related concept. The TestScript resource is an infrastructure support resource used to represent standardized tests to determine an implementation's level of adherence to the FHIR specification.

TestScript is a part of the conformance framework and is used to validate the behavior of FHIR systems, specifically their correct implementation of StructureDefinition, ValueSet, OperationDefinition, CapabilityStatement and other FHIR resources that govern system behavior. TestScript instances may be included as part of ImplementationGuides to help define and test the desired behavior of systems that choose to comply with the implementation guide.

The following resources represent the FHIR conformance framework that are used to express the expected behavior of a FHIR compliant system:

* [ValueSet](file:///C:\temp\valueset.html)
* [ConceptMap](file:///C:\temp\conceptmap.html)
* [StructureDefinition](file:///C:\temp\structuredefinition.html)
* [DataElement](file:///C:\temp\dataelement.html)
* [CapabilityStatement](file:///C:\temp\capabilitystatement.html)
* [OperationDefinition](file:///C:\temp\operationdefinition.html)
* [SearchParameter](file:///C:\temp\searchparameter.html)
* [ImplementationGuide](file:///C:\temp\implementationguide.html)

**Background and Context**

**Background**

The TestScript resource is designed to establish testing as a first class artifact within the FHIR specification. This resource allows defining a suite of tests that can be executed on one or more FHIR servers and clients.

Implementers should be familiar with the testing concepts and descriptions found in [Testing FHIR](file:///C:\temp\testing.html) before working with this resource.

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**Notes**

Please refer to the [Testing FHIR - How Tos](file:///C:\temp\testing.html#howTos) for examples on working with this resource.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\claim\claim-introduction.xml**

**Scope and Usage**

The Claim is used by providers and payors, insurers, to exchange the financial information, and supporting clinical information, regarding the provision of healthcare services with payors an firms which provide data analytics. The primary uses of this resource is to support eClaims, the exchange of proposed or actual services to benefit payors, insurers and national health programs, for treatment payment planning and reimbursement.

The Claim is intended to support:

* Claims - where the provision of goods and services is **complete** and reimbursement is sought.
* Pre-Authorization - where the provision of goods and services is **proposed** and either authorization and/or the reservation of funds is desired.
* Pre-Determination - where the provision of goods and services is **explored** to determine what services may be covered and to what amount. Essentially a 'what if' claim.

The Claim also supports:

* Up to a 3 tier hierarchy of Goods, products, and Services, to support simple to complex billing.
* Multiple insurance programs arranged in a Coordination of Benefit sequence to enable exchange with primary, secondary, tertiary etc. insurance coverages.
* Assignment of benefit - the benefit may be requested to be directed to the subscriber, the provider or another party.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\claimresponse\claimresponse-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\claimresponse\claimresponse-introduction.xml**

**Scope and Usage**

The ClaimResponse resource provides application level error or application level adjudication results which are the result of processing a submitted Claim resource where that Claim may be which is the functional corollary of a Claim, Pre-Determination or a Pre-Authorization.

This is the adjudicated response to a Claim, Pre-determination or Pre-Authorization. The strength of the payment aspect of the response is matching to the strength of the original request. For a Claim the adjudication indicates payment which is intended to be made, for Pre-Authorization and Pre-Determination no payment will actually be made however funds may be reserved to settle a claim submitted later. Only an actual claim may be expected to result in actual payment.

The ClaimResponse resource is the response for the submission of: Claim, Re-adjudication and Reversals.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\contract\contract-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\contract\contract-introduction.xml**

**Scope and Usage**

The Contract resource is the basal resource to convey information of all manner of contracts for financial (e.g. Insurance policies), business arrangements (eg. supply contracts) and privacy and security (e.g. consent directives). Todo

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\contract\contract-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\coverage\coverage-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\coverage\coverage-introduction.xml**

**Scope and Usage**

The Coverage resource is intended to provide the high level identifiers and potentially descriptors of an insurance plan which may used to pay for, in part or in whole, the provision of health care products and services.

This resource may also be used to register 'SelfPay' where an individual or organization other than an insurer is taking responsibility for payment for a portion of the health care costs.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\coverage\coverage-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityrequest\eligibilityrequest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityrequest\eligibilityrequest-introduction.xml**

**Scope and Usage**

The EligibilityRequest provides patient and insurance coverage information to an insurer for them to respond, in the form of an Eligibility Response, with information regarding whether the stated coverage is valid and in-force, and potentially the amount of coverage which may be available to any services classes identified in this request. Todo

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityrequest\eligibilityrequest-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityresponse\eligibilityresponse-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityresponse\eligibilityresponse-introduction.xml**

**Scope and Usage**

The EligibilityResponse resource provides eligibility and plan details from the processing of an EligibilityRequest resource. It combines key information from a payor as to whether a Coverage is in-force, and optionally the nature of the Policy details.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\eligibilityresponse\eligibilityresponse-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentrequest\enrollmentrequest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentrequest\enrollmentrequest-introduction.xml**

**Scope and Usage**

**This resource has not yet undergone proper review by FM. At this time it is a 'stub', is known to be incomplete, and is to be considered as a draft.**

The EnrollmentRequest resource allows for the addition and removal of plan subscribers and their dependents to health insurance coverage.

Todo

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentrequest\enrollmentrequest-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentresponse\enrollmentresponse-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentresponse\enrollmentresponse-introduction.xml**

**Scope and Usage**

**This resource has not yet undergone proper review by FM. At this time it is a 'stub', is known to be incomplete, and is to be considered as a draft.**

The EnrollmentResponse resource provides enrollment and plan details from the processing of an Enrollment resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\enrollmentresponse\enrollmentresponse-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\explanationofbenefit\explanationofbenefit-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\explanationofbenefit\explanationofbenefit-introduction.xml**

**Scope and Usage**

**Notice to ballotors: The name of this resource is referred to in regulations in some jurisdictions and therefor to reduce confusion or issues it may be appropriate to rename this resource, for example to ClaimSummary. Please advise the Financial Managemet Work Group if this is the case for your jurisdaiction and provide a new name recommendation.**

The ExplanationOfBenefit resource combines key information from a Claim, a ClaimResponse and optional Account information to inform a patient of the goods and services rendered by a provider and the settlement made under the patients coverage in respect of that Claim.

This is the logical combination of the Claim, Claim Response and some Coverage accounting information in respect of a single payor prepared for consumption by the subscriber and/or patient. It is not simply a series of pointers to referred-to content models, is a physical subset scoped to the adjudication by a single payor which details the services rendered, the amounts to be settled and to whom, and optionally the coverage used and/or remaining.

Todo

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\explanationofbenefit\explanationofbenefit-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentnotice\paymentnotice-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentnotice\paymentnotice-introduction.xml**

**Scope and Usage**

The PaymentNotice resource indicates the resource for which the payment has been indicated and reports the current status information of that payment. The payment notice may be used by Providers and Payors to advise the Provider or Regulatory bodies of the state of a payment (cheque in the mail/EFT sent, payment cashed, payment cancelled). Employers or Insurance Exchanges may use this to advise Payors of premium payment.

Payors and /or Providers may have the need to advise Providers and/or regulators of the status of Claim settlement and payment completion. This same resource may be used by employers and insurance exchanges to advise Payors that premium payments have been issued and settled.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentnotice\paymentnotice-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentreconciliation\paymentreconciliation-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentreconciliation\paymentreconciliation-introduction.xml**

**Scope and Usage**

The PaymentReconciliation resource provides the bulk payment details associated with a payment by the payor for goods and services rendered by a provider to patients covered by insurance plans offered by that payor. These are the payment reconciliation details which align to the individual payment amounts indicated on discrete ClaimResponses.

Bulk payments need to provide a means to associate the amounts paid again specific Claims, and other financial exchanges and adjustments, to the bulk payment itself in order to reconcile provider accounts receivable.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\paymentreconciliation\paymentreconciliation-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processrequest\processrequest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processrequest\processrequest-introduction.xml**

**Scope and Usage**

**NOTE:** This resource is slated to be refactored and reduced in scope as some of its functionality is taken over by the [Task](file:///C:\temp\task.html) resource as part of the FHIR Workflow refactoring. Readers of this resource are encouraged to review the Task resource and consider using it instead and/or to provide feedback if they feel it will be inadequate to satisfy the use-cases associated with this resource and to express opinions about which purposes they feel ProcessRequest and ProcessResponse should be retained for.

The ProcessRequest resource allows for the specification of an action to be performed on an existing resource or resources and then provides the additional supporting information to support that action. The actions currently defined are: cancel, poll, reprocess, and status.

**Cancel** indicates the resource which is to be reversed and provides both supporting information for the reversal and whether the receiving system is permitted to retain a copy of the reversed resource.

The Cancel is the formal request to cease processing an incomplete prior request or to reverse and/or nullify a complete prior request or information submission. When nullify=true then all copies of the original submission are to be purged, although audit logs may be retained. When Nullify=false a copy of the original request may be retained. A ProcessResponse may be craeted or returned to indicate whether the requestion action was accepted and scucessful.

**Poll** provides supporting information for the poll request. The response to this is a previously undelivered response or a StatusResponse (or other acknowledgement stype resource which may contain errors).

This is a formal request for Payors or systems which require such and/or transports which don't support a 'Get Operation', for the retrieval of pended, held, resources.

A simple Poll request, one which doesn't specify: request, include, exclude or period; would return any pended resource. Specific types of business behaviors may be supported by providing values for the filtering elements, for example:

* Get any pended resource - no filters specified
* Get deferred response to a Claim - specify the Claim in the 'request'
* Get all Supporting Documentation - specify 'SupportingDocumentation' as an 'include'
* Get an Explanation of Benefit - specify 'ExplanationOfBenefit' as an 'include'
* Get a payment reconciliation - specify a 'period' which contains the expected reconciliation creation date, and specify 'PaymentReconciliation' as an 'include'

**Reprocess** indicates the resource which is to be reprocessed, for example a claim to be readjudicated or a specemin or diagnostic image to be re-examined, and provides both supporting information for the reprocessing and the line items which are to be reprocessed.

This is necessary for the limited supporters who require the ability to formally request the reprocessing of specified service sub-trees from an already processed resource such as a previously adjudicated Claim.

**Status** indicates the resource for which the processing status is requested and provides supporting information for the status request.

This is a formal request for Payors which require such and/or transports which don't support a 'Get Operation', for the processing status of a previously submitted processing request.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processrequest\processrequest-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processresponse\processresponse-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processresponse\processresponse-introduction.xml**

**Scope and Usage**

**NOTE:** This resource is slated to be refactored and reduced in scope as some of its functionality is taken over by the [Task](file:///C:\temp\task.html) resource as part of the FHIR Workflow refactoring. Readers of this resource are encouraged to review the Task resource and consider using it instead and/or to provide feedback if they feel it will be inadequate to satisfy the use-cases associated with this resource and to express opinions about which purposes they feel ProcessRequest and ProcessResponse should be retained for.

The ProcessResponse resource indicates the resource for which the processing status is requested and provides simple acknowledgement and status information of application level errors. It may also be used to convey additional processing requirements in a text form.

This is the formal response to a ProcessRequest and may be used as a application level response to PaymentNotice and SupportingDocumentation resources.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\processresponse\processresponse-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\visionprescription\visionprescription-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\visionprescription\visionprescription-introduction.xml**

**Scope and Usage**

This resource covers all prescriptions for glasses and contact lenses for a patient.

**Boundaries and Relationships**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\visionprescription\visionprescription-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingmanifest\imagingmanifest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingmanifest\imagingmanifest-introduction.xml**

**Scope and Usage**

This resource provides information on a selected set of imaging objects, along with information on how to retrieve those instances (either in native DICOM format, or in a rendered format, such as JPEG), or launch an image viewer. The ImagingManifest is used to make available information concerning images etc. that are intended to be exchanged into other clinical contexts such as diagnostic reports, Care Plans, etc.

ImagingManifest provides a FHIR transformation of a DICOM Key Object Selection file as profiled by the IHEâ€™s XDS-I profile. Although ImagingManifest can address certain uses outside XDS-I (such as launching a viewer), it does not provide the full capabilities of a general DICOM Key Object Selection.

More than one ImagingManifest may reference instances from a particular DICOM study (and [ImagingStudy](file:///C:\temp\imagingstudy.html)). A particular ImagingManifest may reference instances from more than one DICOM study (and [ImagingStudy](file:///C:\temp\imagingstudy.html)). An ImagingManifest may reference all instances, or only selected instances from a study.

**Boundaries and Relationships**

In distinction to [ImagingStudy](file:///C:\temp\imagingstudy.html), this resource is a set of specifically selected objects, potentially from multiple studies on the same patient. [ImagingStudy](file:///C:\temp\imagingstudy.html) is intended as the resource that identifies a single complete study in itself.

**Background and Context**

This resource corresponds to a subset of the DICOM Key Object Selection (KOS) SOP Class, and provides a FHIR access to the content of KOS SOP Instances. The content is closely based on the definitions of the equivalent DICOM constructs, and informed by usage patterns already established through DICOM implementation practices, including IHE KIN, TCE, and XDS-I profiles.

The DICOM access methods provide access using the rich controls of the DICOM access methodology indicated. A DICOM capable client may use these access methods to gain full access to the DICOM objects and header.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingmanifest\imagingmanifest-notes.xml**

**Implementation Notes**

A referenced DICOM SOP instance could be:

* A single- or multi-frame, still or video image captured by a variety of imaging modalities, such as X-ray, MR, and ultrasound;
* A set of various presentation parameters, including annotation and markup;
* A set of measurements or a report, including radiation dose report and CAD analysis;
* An encapsulated PDF or CDA document;
* A list of instances, such as key â€œof interestâ€ images, or instances to be â€œdeletedâ€; or
* Other DICOM content.

UID values follow the FHIR convention of expressing UIDs as URNs. For example, the DICOM Study Instance UID of 1.2.250.1.59.40211.12345678.678910 is expressed as â€œurn:oid:1.2.250.1.59.40211.12345678.678910â€.

The ImagingManifest.study.endpoint elements and ImagingManifest.study.series.endpoint elements indicate network services that can be used to access the studies, series, or instances; for example, a DICOM WADO-RS server. An ImagingManifest.study.series.endpoint of a particular Endpoint.connectionType provides that service for that series, and all contained instances. An ImagingManifest.study.endpoint of a particularconnection type provides that service for all series in that study that do not have a specified Endpoint of that type, and their contained instances. That is, an ImagingManifest.study.series.endpoint overrides a ImagingManifest.study.endpoint of the same connection type. (Since each study, or individual series of a study can be stored on different imaging archive servers, per-series endpoints are required. For the identified services and use cases, all instances within a series would be stored together, and thus instance-level endpoints are not defined.)

Different Endpoint connection types may have different capabilities, protocols or requirements; and the specified Endpoint.url may require manipulation. For the details on use of imaging-related Endpoint connection types, See [ImagingStudy Implementation Notes](file:///C:\temp\imagingstudy.html#endpoint) for details.

**Use Case**

**EHR access to imaging studies**

Amy, a family physician, is accessing a cross-enterprise document registry that contains radiology objects ([IHE Radiology XDS-I](http://www.ihe.net)), to discover studies for her patient, Alex. Her EHR client makes a FHIR call for all [ImagingManifest](file:///C:\temp\imagingmanifest.html) objects available for Alex. In the response, she is able to get study identifiers for each study that has been published to the registry. There is enough information provided in the response to obtain a thumbnail via a WADO-RS call, or to launch a viewer using an [IHE Radiology - Invoke Image Display (IID)](http://www.ihe.net) profile call using the url elements found in the [ImagingManifest](file:///C:\temp\imagingmanifest.html). In each result, there is a reference to the [ImagingStudy](file:///C:\temp\imagingstudy.html) FHIR object which can provide more information about each study.

**Comprehensive Imaging Scheduled Workflow**

Joe Angina complains of shortness of breath and occasional chest pain to his primary care physician, Dr. Pat Down at Local MultiClinic, who orders a stress echocardiogram; the order is created as a FHIR [Task](file:///C:\temp\task.html) resource to manage the workflow, with a link to a [ProcedureRequest](file:///C:\temp\procedurerequest.html) resource with the details of the request. The order is scheduled and assigned to cardiologist Dr. Art Skann, also at Local MultiClinic.

On the scheduled day of the exam, Joe arrives at the echo lab to meet with Dr. Skann and have the study done. Dr. Skannâ€™s workstation shows the daily list of [Task](file:///C:\temp\task.html), and he follows the link to retrieve the [ProcedureRequest](file:///C:\temp\procedurerequest.html). (He may follow the links through the referenced [Patient](file:///C:\temp\patient.html) resource to access Joeâ€™s electronic medical record, but that is not the concern of this storyboard.)

The [Task](file:///C:\temp\task.html) and [ProcedureRequest](file:///C:\temp\procedurerequest.html) has been transcoded to a DICOM Modality Worklist Scheduled Procedure Step, and in the echo lab the equipment has downloaded the Modality Worklist. The study is performed, and the acquired images and sonographerâ€™s preliminary measurements are stored in the Local MultiClinic Picture Archiving and Communication System (PACS). The PACS creates an [ImagingStudy](file:///C:\temp\imagingstudy.html) resource for each study it manages.

Dr. Skann interprets the study on a PACS workstation, and he selects two key image frames to be included in the diagnostic report; this selection is stored back to the PACS as a DICOM Key Object Selection with the title "For Report Attachment", and the PACS makes it available (transcodes it) as a FHIR [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource. Dr. Skann dictates the report using a structured data entry report writing program, including a recommendation for a cardiac catheterization procedure, and signs it. The report writing program formats the report as a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) document, retrieves the [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource, and inserts the referenced key images into the report.

Dr. Down meets again with Joe, and they review the results of the stress test. Joe has a question about the findings that the key images in the report do not show, so Dr. Down uses the Local MultiClinic EMR to query the PACS for the full [ImagingStudy](file:///C:\temp\imagingstudy.html) resource, and uses the references there to open an image display for the full study. Joe agrees to proceed to catheterization, and Dr. Down sends a referral to the Ginormous University Hospital cath department, and triggers the PACS to share the echo study through the Metropolitan Health Information Exchange.

The PACS creates a manifest of the study as an [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource, which includes all the images but excludes the sonographerâ€™s preliminary measurements (which as a matter of policy are not shared outside the Local MultiClinic). The manifest is published to the Metro HIE. (In accordance with [IHE XDS-I](http://www.ihe.net), the images themselves are not directly published to the HIE, but available for on-demand retrieval from the PACS.)

At Ginormous Hospital, Dr. Cora Plummer receives the cath referral, and looks up the study in the Metro HIE registry. She retrieves the study manifest [ImagingManifest](file:///C:\temp\imagingmanifest.html), and uses it to access the shared images, which she uses to prepare for the cath procedure.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingstudy\imagingstudy-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingstudy\imagingstudy-introduction.xml**

**Scope and Usage**

ImagingStudy provides information on a DICOM imaging study, and the series and imaging objects in that study. It also provides information on how to retrieve that information (in a native DICOM format, or in a rendered format, such as JPEG). ImagingStudy is used to make available information about all parts of a single DICOM study.

This resource provides mappings of its elements to DICOM attributes. DICOM attributes are identified by a 32-bit tag, presented in canonical form as two four-digit hexadecimal values within parentheses and separated by a comma, e.g. (0008,103E). The name and value representation (data type) of each attribute can be found in [DICOM Part 6 Data Dictionary](http://medical.nema.org/medical/dicom/current/output/html/part06.html). The use of the attributes in the context of information objects, including detailed description of use, can be found in [DICOM Part 3 Information Object Definitions](http://medical.nema.org/medical/dicom/current/output/html/part03.html). Attributes used in the DICOM query information models, such as "Number of Instances in Study", can be found in [DICOM Part 4 Annex C](http://medical.nema.org/medical/dicom/current/output/html/part04.html#chapter_C).

ImagingStudy provides access to significant DICOM information, but will only eliminate the need for DICOM query (e.g., QIDO-RS) in the simplest cases. The DICOM instances are not stored in the ImagingStudy resource; use of a DICOM WADO-RS server or other storage mechanism is needed.

Only a single DICOM study may be referenced from one ImagingStudy. In many cases, only one ImagingStudy will reference a particular DICOM study, but this is not required.

**Boundaries and Relationships**

In contrast to [ImagingManifest](file:///C:\temp\imagingmanifest.html), this resource represents all of the known imaging objects from a single study. Imaging Manifest represents selected instances from multiple studies for one patient.

ImagingStudy is used for DICOM imaging and associated information. Use [Media](file:///C:\temp\media.html) to track non-DICOM images, video, or audio. [Binary](file:///C:\temp\binary.html) can be used to store arbitrary content. [DocumentReference](file:///C:\temp\documentreference.html) allow indexing and retrieval of clinical â€œdocumentsâ€ with relevant metadata.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\imagingstudy\imagingstudy-notes.xml**

**Implementation Notes**

A referenced DICOM SOP instance could be:

* A single- or multi-frame, still or video image captured by a variety of imaging modalities, such as X-ray, MR, and ultrasound;
* A set of various presentation parameters, including annotation and markup;
* A set of measurements or a report, including radiation dose report and CAD analysis;
* An encapsulated PDF or CDA document;
* A list of instances, such as key â€œof interestâ€ images, or instances to be â€œdeletedâ€; or
* Other DICOM content.

UID values follow the FHIR convention of expressing UIDs as URNs. For example, the DICOM Study Instance UID of 1.2.250.1.59.40211.12345678.678910 is expressed as â€œurn:oid:1.2.250.1.59.40211.12345678.678910â€.

The ImagingManifest.study.endpoint elements and ImagingManifest.study.series.endpoint elements indicate network services that can be used to access the studies, series, or instances; for example, a DICOM WADO-RS server. An ImagingManifest.study.series.endpoint of a particular Endpoint.connectionType provides that service for that series, and all contained instances. An ImagingManifest.study.endpoint of a particularconnection type provides that service for all series in that study that do not have a specified Endpoint of that type, and their contained instances. That is, an ImagingManifest.study.series.endpoint overrides a ImagingManifest.study.endpoint of the same connection type. (Since each study, or individual series of a study can be stored on different imaging archive servers, per-series endpoints are required. For the identified services and use cases, all instances within a series would be stored together, and thus instance-level endpoints are not defined.)

Different Endpoint connection types may have different capabilities, protocols or requirements; and the specified Endpoint.url may require manipulation. For the details on use of imaging-related Endpoint connection types, See below for details.

**WADO-RS**

An Endpoint.connectionType of code dicom-wado-rsi, system http://hl7.org/fhir/endpoint-connection-type, identifies a DICOM WADO-RS service. The Endpoint.address identifies the HTTP(S) service base url. That is, only the scheme, authority and path are included. Sub-services, such as study, shall not be specified. The path shall not contain a trailing slash.

The DICOM WADO-RS (Web Access to DICOM Objects, RESTful mode) service uses a RESTful approach to instance retrieval. This service allows for retrieval of native DICOM SOP instances, or instances â€œrenderedâ€ into other formats, including JPEG and MPEG. The media type of a response is specified by the request Accept header (preferred); or, by the accept query parameters. Supported media types depend on the capabilities of the WADO-RS server and the classification of the instance as â€œsingle frame,â€ â€œmulti-frame,â€ â€œvideo,â€ â€œtext,â€ or â€œother.â€ The WADO-RS service also allows retrieval of study or series level information.

The path to retrieve a DICOM instance is constructed by appending the appropriate sub-resource paths to the Endpoint.address value.

For example, a native DICOM PS3.10 instance file can be retrieved (if consistent with the Accept header) by performing a GET on a URL constructed from a Endpoint.address of â€œhttps://pacs.hospital.org/wado-rsâ€, the study.uid value of â€œurn:oid:1.2.250.1.59.40211.12345678.678910â€, study.series.uid value of â€œurn:oid:1.2.250.1.59.40211.789001276.14556172.67789â€, and study.series.instance.uid value of â€œurn:oid:1.2.250.1.59.40211.2678810.87991027.899772.2â€:

https://pacs.hospital.org/wado-rs/studies/1.2.250.1.59.40211.12345678.678910/series/1.2.250.1.59.40211.789001276.14556172.67789/instances/1.2.250.1.59.40211.2678810.87991027.899772.2

Query parameters on the "rendered" sub-resource can control other aspects of the rendering including: the rendered dimensions, the quality (compression ratio), the region of interest to render, the brightness/contrast (window center/width) adjustments, and whether to â€œburnâ€ patient or study demographics into the rendered result. Specific frames of a multi-frame instance may be retrieved using the frames sub-resource.

For example, provided the Accept header indicates a preference for image/jpeg, the example above can be extended with parameters that cause a JPEG thumbnail (100 columns by 100 rows) of a region extending from the top-left corner of the original image, across 1000 and down 3000 pixels, to be retrieved (additional sub-resource and parameters emphasized):

https://pacs.hospital.org/wado-rs/studies/1.2.250.1.59.40211.12345678.678910/series/1.2.250.1.59.40211.789001276.14556172.67789/instances/1.2.250.1.59.40211.2678810.87991027.899772.2**/rendered?viewport=100,100,0,0,1000,3000**

For further details on DICOM WADO-RS capabilities including additional rendering parameters, see [DICOM PS 3.18](http://dicom.nema.org/medical/dicom/current/output/chtml/part18/PS3.18.html).

**WADO-URI**

An Endpoint.connectionType of code dicom-wado-uri, system http://hl7.org/fhir/endpoint-connection-type, identifies a DICOM WADO-URI service. The Endpoint.address identifies the HTTP(S) service base url. That is, only the scheme, authority and path are included. Neither a quetstion mark (?) nor any query parameters shall be included.

The DICOM WADO-URI (Web Access to DICOM Objects, URI mode) service uses HTTP query parameter syntax. This service allows for retrieval of native DICOM instances, or instances â€œrenderedâ€ into other formats, including JPEG and MPEG. The media type of a response is specified by the request Accept header (preferred); or, by the contentType query parameter. Supported media types depend on the classification of the instance as â€œsingle frame,â€ â€œmulti-frame,â€ â€œvideo,â€ â€œtext,â€ or â€œother.â€

The query to retrieve a DICOM instance is constructed by appending the appropriate query parameters to the Endpoint.address.url.

For example, a native DICOM PS3.10 instance file can be retrieved (if consistent with the Accept header) by performing a GET on a URL constructed from a Endpoint.address.url of â€œhttps://pacs.hospital.org/wado-uriâ€, the study.uid value of â€œurn:oid:1.2.250.1.59.40211.12345678.678910â€, study.series.uid value of â€œurn:oid:1.2.250.1.59.40211.789001276.14556172.67789â€, and study.series.instance.uid value of â€œurn:oid:1.2.250.1.59.40211.2678810.87991027.899772.2â€:

https://pacs.hospital.org/wado-uri?requestType=WADO&studyUID=1.2.250.1.59.40211.12345678.678910&seriesUID=1.2.250.1.59.40211.789001276.14556172.67789&objectUID=1.2.250.1.59.40211.2678810.87991027.899772.2

Additional query parameters can control other aspects of the rendering including rendered dimensions, quality (compression ratio), the region of interest within the image to render, brightness/contrast (window center/width) adjustments, whether to â€œburnâ€ patient or study demographics into the rendered result, and which frame of a multi-frame instance to retrieve.

For example, provided the Accept header indicates a preference for image/jpeg, the example above can be extended with parameters that cause a JPEG thumbnail (100 columns by 100 rows) of the left half of the image to be retrieved (additional parameters emphasized):

https://pacs.hospital.org/wado-uri?requestType=WADO&studyUID=1.2.250.1.59.40211.12345678.678910&seriesUID=1.2.250.1.59.40211.789001276.14556172.67789&objectUID=1.2.250.1.59.40211.2678810.87991027.899772.2&**rows=100&columns=100&region=0,0,0.5,1**

For further details on DICOM WADO-URI capabilities including additional rendering parameters, see [DICOM PS 3.18](http://dicom.nema.org/medical/dicom/current/output/chtml/part18/PS3.18.html).

**IID**

An Endpoint.connectionType of code ihe-iid, system http://hl7.org/fhir/endpoint-connection-type, identifies an IHE **Invoke Image Display (IID)** service. The Endpoint.address identifies the HTTP(S) service base url. That is, only the scheme, authority and path are included. Neither the question mark (â€œ?â€) nor any query parameters shall be included.

The IHE **Invoke Image Display (IID)** service provides a standardized mechanism to launch a viewer in a particular study context. (IID also supports invoking a particular patient context, but that is not profiled here.) An IID-type Endpoint should be used only at the study level. As well as invoking the viewer on a particular study, query parameters can request particular viewer capabilities, image quality, and more.

To launch a viewer, append the appropriate query parameters to Endpoint.address value.

For example, given an Endpoint.address of https://pacs.hospital.org/IHEInvokeImageDisplay, to invoke a diagnostic quality viewer on the study with study.uid value of â€œurn:uri:1.2.250.1.59.40211.12345678.678910â€, the following URL would be constructed:

https://pacs.hospital.org/IHEInvokeImageDisplay?requestType=STUDY&studyUID=1.2.250.1.59.40211.12345678.678910&diagnosticQuality=true

For further details on IHE Invoke Image Display capabilities including additional parameters, see the [IHE Technical Frameworks](http://www.ihe.net/Technical_Frameworks/#radiology), or the introduction on the [IHE IID Profile Wiki](http://wiki.ihe.net/index.php/Invoke_Image_Display).

**Use Case**

**EHR access to imaging studies**

Amy, a family physician, would like to see a list of available studies for her patient, Alex. Her EHR client makes a FHIR call for all [ImagingStudy](file:///C:\temp\imagingstudy.html) objects available for Alex. In the response, she is able to see the study date, procedure, modality, and accession number, for each study returned. There is enough information provided in the response to obtain a thumbnail via a WADO-RS call, or to launch a viewer using an [IHE Radiology - Invoke Image Display (IID)](http://www.ihe.net) profile call using the url elements found in the [ImagingStudy](file:///C:\temp\imagingstudy.html).

**Comprehensive Imaging Scheduled Workflow**

Joe Angina complains of shortness of breath and occasional chest pain to his primary care physician, Dr. Pat Down at Local MultiClinic, who orders a stress echocardiogram; the order is created as a FHIR [Task](file:///C:\temp\task.html) resource to manage the workflow, with a link to a [ProcedureRequest](file:///C:\temp\procedurerequest.html) resource with the details of the request. The order is scheduled and assigned to cardiologist Dr. Art Skann, also at Local MultiClinic.

On the scheduled day of the exam, Joe arrives at the echo lab to meet with Dr. Skann and have the study done. Dr. Skannâ€™s workstation shows the daily list of [Task](file:///C:\temp\task.html), and he follows the link to retrieve the [ProcedureRequest](file:///C:\temp\procedurerequest.html). (He may follow the links through the referenced [Patient](file:///C:\temp\patient.html) resource to access Joeâ€™s electronic medical record, but that is not the concern of this storyboard.)

The [Task](file:///C:\temp\task.html) and [ProcedureRequest](file:///C:\temp\procedurerequest.html) has been transcoded to a DICOM Modality Worklist Scheduled Procedure Step, and in the echo lab the equipment has downloaded the Modality Worklist. The study is performed, and the acquired images and sonographerâ€™s preliminary measurements are stored in the Local MultiClinic Picture Archiving and Communication System (PACS). The PACS creates an [ImagingStudy](file:///C:\temp\imagingstudy.html) resource for each study it manages.

Dr. Skann interprets the study on a PACS workstation, and he selects two key image frames to be included in the diagnostic report; this selection is stored back to the PACS as a DICOM Key Object Selection with the title "For Report Attachment", and the PACS makes it available (transcodes it) as a FHIR [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource. Dr. Skann dictates the report using a structured data entry report writing program, including a recommendation for a cardiac catheterization procedure, and signs it. The report writing program formats the report as a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) document, retrieves the [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource, and inserts the referenced key images into the report.

Dr. Down meets again with Joe, and they review the results of the stress test. Joe has a question about the findings that the key images in the report do not show, so Dr. Down uses the Local MultiClinic EMR to query the PACS for the full [ImagingStudy](file:///C:\temp\imagingstudy.html) resource, and uses the references there to open an image display for the full study. Joe agrees to proceed to catheterization, and Dr. Down sends a referral to the Ginormous University Hospital cath department, and triggers the PACS to share the echo study through the Metropolitan Health Information Exchange.

The PACS creates a manifest of the study as an [ImagingManifest](file:///C:\temp\imagingmanifest.html) resource, which includes all the images but excludes the sonographerâ€™s preliminary measurements (which as a matter of policy are not shared outside the Local MultiClinic). The manifest is published to the Metro HIE. (In accordance with [IHE XDS-I](http://www.ihe.net), the images themselves are not directly published to the HIE, but available for on-demand retrieval from the PACS.)

At Ginormous Hospital, Dr. Cora Plummer receives the cath referral, and looks up the study in the Metro HIE registry. She retrieves the study manifest [ImagingManifest](file:///C:\temp\imagingmanifest.html), and uses it to access the shared images, which she uses to prepare for the cath procedure.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\messagedefinition\messagedefinition-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\messagedefinition\messagedefinition-introduction.xml**

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**Scope and Usage**

Implementers should be familiar with the messaging concepts and descriptions found in [Messaging using FHIR Resources](file:///C:\temp\messaging.html) before working with this resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\messagedefinition\messagedefinition-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\messageheader\messageheader-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\messageheader\messageheader-introduction.xml**

**Scope and Usage**

The MessageHeader resource is defined in order to support [Messaging using FHIR resources](file:///C:\temp\messaging.html). The principle usage of the MessageHeader resource is when messages are exchanged. However, as a resource that can be used with the RESTful framework, the MessageHeader resource has the normal resource end-point ([base-url]/MessageHeader), which is used to manage a set of static messages resources. This could be used to make an archive of past messages available. **Creating or updating Message 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 resources.

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**Notes:**

* The resources referenced by the enterer, author and responsible elements may all be included in the message bundle or left out on the basis that the recipient (and any intermediaries) are able to locate/resolve the resources independently. The former would be suitable for loosely coupled systems, and the latter for tightly coupled systems. The messaging Capability statement for an application may reference a [Structure Definition](file:///C:\temp\structuredefinition.html) that describes how the bundling occurs
* The actual content of the focus resource is specified for each message event (see [the list on the messaging page](file:///C:\temp\messaging.html#events)). Any resources referenced in the focus element are always included in the bundle
* If *MessageHeader.source.endpoint* and *MessageHeader.destination.endpoint*, are literal URLs, then they SHOULD identify the addresses to which messages can be delivered. If they are logical URIs (i.e. non-dereferenceable), message delivery intermediaries must know how to deliver the message to the destination application.
* The author and the receiver are not the actual technical systems - these are the human or organizations that make use of the technical systems
* A receiver is not obligated to reject messages which do not explicitly identify it as receiver (e.g. a tracker will get messages that are destined for some other system)
* The value set MessageEvent is populated by the authors of the resources declaring the events

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bodysite\bodysite-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bodysite\bodysite-introduction.xml**

**Scope and Usage**

The BodySite resource contains details about the anatomical location of a specimen or body part, including patient information, identifiers, as well as text descriptons and images. It provides for the addition of qualifiers such as laterality and directionality to the anatomic location for those use cases where precoordination of codes is not possible. The BodySite resource supports recording and tracking of an anatomic location or structure on a patient outside the context of another resource. For example it can be the target of a [Procedure](file:///C:\temp\procedure.html) resource or [Observation](file:///C:\temp\observation.html) resource.

**Boundaries and Relationships**

The BodySite resource is not intended to substitute for precoordination of codes. If precoordination of codes is supported by an implementation the codeableConcept should be used. This resource is not intended for describing the type of anatomical location but rather a specific body site on a specific patient.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\bodysite\bodysite-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\dataelement\dataelement-11179-profile-introduction.xml**

**Scope and Usage**

This profile defines extensions that may be useful in exposing data elements from [ISO 11179](http://metadata-standards.org/11179)-conformant registries. The list of extensions is not currently complete - additional extensions would be required to support all required and optional 11179 elements. The set of define extensions will increase over time based on implementer interest. At some point, a full profile for 11179-conformant systems may be developed.

The list of defined extensions is as follows:

* **objectClass** - specifies the Object\_Class for a Concept\_Element or the meaning of a Data\_Element
* **property** - specifies the Object\_Class Property for a Concept\_Element or the meaning of a Data\_Element

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\dataelement\dataelement-examples-header.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\dataelement\dataelement-introduction.xml**

**Scope and Usage**

DataElement is an infrastructure resource that supports the defining individual pieces of data that might be collected or stored. While these definitions might apply to elements found in FHIR resources and profiles, they can also apply to questionnaire questions, elements in data stores, and non-FHIR specification ([HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185), [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7), CDISC, etc.) I.e. the definitions aren't FHIR-specific.

This resource covers two major use-cases:

1. Definitions of types of measurements or observations that may be requested or performed. In HL7, these are sometimes referred to as service, test or observation "master files"
2. Definitions of "data elements" (DEs) that may be used in [questionnaires](file:///C:\temp\questionnaire.html) (survey instruments and data collection forms) and [profiles](file:///C:\temp\profile.html) and potentially mapped to elements in other resources and profiles

The purpose of the first use-case is to allow systems to identify what types of lab orders, diagnostic studies and other types of observations may be requested or performed within a particular organization or other context. An ordering practitioner can query for a list of data elements by category name or other criteria and identify which, within a set of similar tests, they wish to request to be performed.

The focus of the second use-case is standardizing data capture and reporting. By defining standard names, data capture constraints, questions and other characteristics, the data gathered within and across organizations via questionnaires, as part of clinical studies, etc. can be made more consistent. When designing clinical studies, constructing questionnaires, building profiles or performing other tasks that involve determining what data will be captured or exchanged and how, designers can query to find pre-defined data element definitions they can leverage or map to. By encouraging consistency around data element definitions, data types, value sets, string lengths and other constraints, data becomes more easily exchangeable and comparable across systems. This benefits interoperability and clinical research. (For more discussion, see the section on [standardization](file:///C:\temp\intros%20and%20notes.html#standardization) below.)

The scope covers base capabilities of the ISO 11179 Metadata Registries specification which defines DEs. It also covers observation definitions by ontologies such as LOINC. The term "observation" is interpreted in its broadest sense as "any element that might be thought of as the 'value' in a name-value pair". So it includes such concepts as patient gender, practitioner address and other data elements that would not typically be captured using the [Observation](file:///C:\temp\observation.html) resource.

**Boundaries and Relationships**

This resource has significant overlap with [StructureDefinition](file:///C:\temp\structuredefinition.html) and [Questionnaire](file:///C:\temp\questionnaire.html).

[StructureDefinition](file:///C:\temp\structuredefinition.html) also defines data elements. However, it does so only in the context of FHIR-specific artifacts (FHIR resources, data types and profiles). As well, StructureDefinition typically identifies a number of data elements together in context. **DataElement** defines only a single data element and it does so in a manner that is not directly tied to FHIR. Data elements might define the value of an [Observation](file:///C:\temp\observation.html), constrain the allowed answer to a question in a [Questionnaire](file:///C:\temp\questionnaire.html) (including providing a list of permitted answers), describe the permitted value captured of an element in some other resource ([Patient](file:///C:\temp\patient.html), [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html), etc.) or even used outside FHIR entirely in a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) document or [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) specification.

[Questionnaire](file:///C:\temp\questionnaire.html) is to both define forms, surveys and other structures that can be filled out. [Questionnaire](file:///C:\temp\questionnaire.html) also defines data elements. However, it does so only in the context of a particular questionnaire design. In contrast, **DataElement** is focused on defining data elements independent of their use in questionnaires and other structures. A single **DataElement** might be referenced in numerous [Questionnaire](file:///C:\temp\questionnaire.html)s, or even potentially in multiple places within a single [Questionnaire](file:///C:\temp\questionnaire.html). This reference might either be implicit or may be explicit through an extension. (For implementability reasons, the data constraints should still be explicitly exposed within the [Questionnaire](file:///C:\temp\questionnaire.html) rather than being included "by reference" to the **DataElement**.)

**Note**: Extensions on **DataElement** that define the characteristics of a data element will typically also be applicable to [Profile](file:///C:\temp\profile.html)'s ElementDefinition and [Questionnaire](file:///C:\temp\questionnaire.html)'s Question data element as both are also used to define the characteristics of a data element.

**DataElement** differs from [Observation](file:///C:\temp\observation.html) in that it describes what kind of observations **can** occur, while [Observation](file:///C:\temp\observation.html) focuses on a specific observation of a specific subject at a particular time that **has** occurred.

[ActivityDefinition](file:///C:\temp\activitydefinition.html) defines actions that can occur. DataElement defines individual pieces of data that can be captured. An ActivityDefinition that is focused on capturing data might be linked to the DataElement that defines the data to be captured.

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**Relationship to ISO 11179**

One of the sources of the **DataElement** resource definition was the [ISO 11179](http://metadata-standards.org/11179/) Metadata Registries specification. It defines a logical model for the classification, identification, naming and registration of Data Elements, Data Element Concepts and their associated Value and Conceptual Domains.

The **DataElement** resource can be used to represent both Data\_Element and Data\_Element\_Concept in the ISO logical model. (The [ValueSet](file:///C:\temp\valueset.html) resource provides the details for Value\_Domain and Conceptual\_Domain for enumerated elements.) The determination of whether a **DataElement**resource instance is an ISO 11179 Data\_Element or Data\_Element\_Concept is determined by  whether the type property is specified - which corresponds to the ISO property Data\_Element.domain.datatype which is required for Data\_Elements.

Unlike the 11179 logical specification, the **DataElement** resource does not require a linkage from data element to a distinct data element concept, though this linkage can be established through an extension if desired. The typical means of identification of the data element concept is expected to instead occur through the mapping of the data element to a particular code or reference model that formally defines the concept. It is possible this reference model could be based on ISO's Object\_Class and Property mechanism. However, mappings to other reference models are also possible, for example:

* HL7's [Reference Information Model](http://www.hl7.org/implement/standards/rim.cfm)
* [Open EHR's](http://www.openehr.org/) reference model
* the [BRIDG](http://bridgmodel.nci.nih.gov/about_bridg) logical model
* terminologies such as [LOINC](http://loinc.org) or [SNOMED CT](http://www.ihtsdo.org/snomed-ct/)

In the event of multiple codes and/or mappings, the "authoritative" mapping (the one formally defining the concept) is identified by either setting the "primary" element on the code or by specifying the "primary mapping" ISO 11179 extension.

It is possible to create instances that are "conforming", or even "strictly conforming" to the 11179 specification. However, doing so will require the use of extensions to convey certain properties that are not part of the core resource and data types. An initial starter [ISO 11179 profile](file:///C:\temp\dataelement-11179.html) is included in the FHIR specification. It defines extensions that are relevant to the [SDC DataElement](http://hl7.org/fhir/us/sdc/dataelement-sdc.html) profile. If there is sufficient interest, the existing starter set may be enhanced to contain a complete set of extensions and a full 11179 in a future release of the specification.

**Data Elements vs. Codes**

Data elements (and their registries) and codes (and their code systems) serve different purposes. Data elements describe the characteristics of a piece of data - identifier, name, definition, data type, length, permitted value set, usage notes, etc. On the other hand, while codes describe a particular concept including a symbol for use when exchanging the concept, display names, definitions and relationships to other concepts. There is a subset of information that is common for both codes and data elements - identifier, name and definition. Because of this, a list of data elements might sometimes be seen as a list of codes.

One of the purposes of data elements is to define variables, observations, or questions that include information about how to collect a variable's value--including information about data types and guidance about the use of about answer lists and/or units of measure. This function is typically done by code systems such as [LOINC](http://loinc.org) and [SNOMED CT](http://www.ihtsdo.org/snomed-ct/). (Note that LOINC provides considerable detail about allowed answers, while most other code systems such as SNOMED CT only allow identifying the question.) It would be possible to treat a registry of data elements using a common identifier system/namespace as a code system. Similarly, data elements can be mapped to each other (and to codes) in the same manner as codes can be mapped by making use of the [ConceptMap](file:///C:\temp\conceptmap.html) resource.

That said, FHIR treats code systems as simple structures that provide identity, names and definitions. Code systems that provide significant additional detail (recommended doses for drugs, data types for data elements, etc.) are treated as a mix of a code system together with a supplementary resource to provide the details. Refer to the [Code systems with detailed metadata](file:///C:\temp\valueset.html#detailed-metadata) section of [ValueSet](file:///C:\temp\valueset.html) resource for additional discussion of the relationship between DataElement and code systems.

**Standardization through governance and registries**

As noted in the introduction, one of the main purposes for the use of data elements is 'standardization' - gaining consistent (and thus comparable) data capture of data in [questionnaires](file:///C:\temp\questionnaire.html), [observations](file:///C:\temp\observation.html) and within other resources. However, merely defining data elements is not, in itself, sufficient to improve standardization. To ensure consistency of data, there needs to be several additional things:

* There must be a shared repository of data elements that will be consulted and used by the community where improved interoperability is targeted. Numerous groups will define and register data elements in a wide variety of repositories for a wide variety of purposes. To improve interoperability, everyone in the target community needs to be working from the same set.
* There must be governance over the repository of data elements to ensure consistency of granularity and reference structures - those designing questionnaires, profiles, etc. need to be able to find the appropriate data element easily within the repository and there should ideally only be one data element for a given purpose. If a repository accepts 15 data elements defining different ways of capturing the same piece of information, there will be no improvement in interoperability.
* There must be incentives or governance processes in place that encourage or require the use of data elements from the shared repository when defining forms, profiles and other structures where improved interoperability is desired.
* There must be allowance for (and a transition path for) legacy systems that capture data or have existing data that is not in alignment with the approved data elements.

**Data Elements** are a tool through which improved standardization can be achieved but without adequate processes, they will not achieve significant benefit.

**Data Element granularity and hierarchy**

Data elements can be defined at a wide variety of granularities. For example:

* Systolic Blood pressure
* Systolic Blood pressure (sitting)
* Systolic Blood pressure (sitting, pressure cuff)
* Systolic Blood pressure (sitting, pressure cuff) mmHg

Coded data elements can be defined without value sets, with suggested value sets, with required but extensible value sets or with completely locked down value sets. Numeric values can be defined with or without allowed ranges. String data can be defined with or without patterns or lengths. All are valid data elements.

When defining data elements, it's important to decide what level of detail/granularity is appropriate for the intended purpose. The tighter the data element is defined, the greater interoperability of the data, however the smaller the set of systems that will be able to satisfy the constraints and the larger the number of data elements that will be required to cover a given domain. In some cases, multiple granularities may be appropriate, though this can introduce challenges in ensuring that the appropriate granularity is selected for a given use. As a rule, data elements should be defined as loosely as possible while still ensuring that all data captured using the data element will be sufficiently comparable to meet the needs of the group defining and using the data elements. A corollary to this is that data elements defined by one group will not always meet the needs of another group, even if they may be covering the same domain.

**Comparability and conversion of data elements**

Two pieces of data don't necessarily need to be based on the same data element in order to be comparable or aggregatable. As noted above, it's possible for one data element to be a proper subset of another. In addition, it may be possible to convert data from being conformant with one data element to being conformant with another data element. This conversion could be lossless or may involve some loss of semantic precision. For example, a weight measurement captured in pounds can be seamlessly converted to kilograms. Similarly, coded data captured using one value set can be converted to another value set provided mappings are available. The nature of the mappings would determine whether any loss of semantics would occur.

**Data Element stringency**

The stringency element allows identifying the types of usages for which the data element is appropriate. Some uses (direct comparison of data, auto-population of data, etc.) are inappropriate with loose definitions of elements. On the other hand, overly-restrictive data elements can result in a large number of data elements and limited abilities to compare similar but not identical data. For now, the definition of what level of constraints are appropriate/necessary for a given level of stringency is left to implementers, though future versions this specification may assert at least some level of guidance in this area.

**Definitions**

Data elements provide their value by clearly defining the meaning and content of a particular type of data to be exchanged. This value depends on the meaning associated with the element being clear for all potential implementers of the element. I.e. For a data element to be useful, it needs to have a good quality definition. Characteristics of good quality definitions include:

* The definition does not use the name of the element as part of the definition - it should provide additional information above and beyond the name.
* The definition should be more than one or two words.
* Ideally, the definition should be phrased in a manner such that the definition could be substituted for the data element name in a sentence; e.g. "gender" might be defined as "the sexual identity of a person as used for administrative purposes"
* If the data element does not have a value set and does not make use of a simple type such as date, integer or boolean, it should list several example values as part of the definition.
* Information about the rationale for the element or additional usage notes should not be conveyed as part of the definition but should instead make use of the notes or rationale elements.

**Data Elements and Access Control**

Because Data Elements define precise pieces of data that can be conveyed in a variety of places, they may form a useful mechanism for the definition of fine-grained data access controls. The base resource does not include mechanisms for linking access controls directly do data elements, however, an extension could allow a particular data element to be associated with particular [Security Labels](file:///C:\temp\security-labels.html). Whether this level of control is appropriate may vary by implementation environment.

**References to and from Data Elements**

One of the primary purposes of the DataElement resource is to allow data conveyed in a variety of different forms to be "linked" to the data element and identified as being equivalent/comparable/semantically-aligned. There are a variety of different ways this can occur:

* DataElement.element.code allows a data element to be linked as "semantically equivalent" to the specified code.
* DataElement.element.mapping allows a data element to be linked to a particular data structure such as a FHIR resource, a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) template, an OpenEHR archetype, etc.
* The [Questionnaire.item.definition](file:///C:\temp\questionnaire.html) allows a particular question in a questionnaire to be linked to a data element definition deemed to correspond to that question. This mechanism supports population of questionnaire instances on the basis of known data elements. The intent is that a server will populate anything it recognizes by data elements. However servers may not know all the data elements, and won't populate ones that they don't know.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\device\device-introduction.xml**

**Scope and Usage**

This resource is an administrative resource that tracks individual device types or instances of a device and their location. It is referenced by other resource for recording which device performed an action such as a procedure or an observation. It is also referenced when prescribing and dispensing devices for patient use or for ordering supplies. It is used to record and transmit [Unique Device Identifer (UDI)](file:///C:\temp\device.html#5.11.3.2.2) information about a device such as a patient's implant.

**Boundaries and Relationships**

These are the device related resources

* Device (this resource)
* [DeviceMetric](file:///C:\temp\devicemetric.html) - Describes a measurement, calculation or setting capability of a medical device.
* [DeviceComponent](file:///C:\temp\devicecomponent.html) that the DeviceMetric is part of. This can be a DeviceComponent of any kind like a VirtualMedicalDevice (VMD), a MedicalDeviceSystem (MDS) , or a Channel

In FHIR, the "Device" is the "administrative" resource for the device (it does not change much and has manufacturer information etc.), whereas the DeviceComponent and DeviceMetric (which is really a kind of DeviceComponent) model the physical part, including operation status and is much more volatile. The physical composition of a Device is done by the DeviceComponents pointing to their "parent" component using [DeviceComponent.parent](file:///C:\temp\devicecomponent-definitions.html#DeviceComponent.parent), e.g. channel to VMD and VMD to the MDS. All components point to the "logical" Device they belong to, using [DeviceComponent.source](file:///C:\temp\devicecomponent-definitions.html#DeviceComponent.source). Similarly, if for example you want to express which logical device your observation came from, you can just use Device, but if you need to be more specific observation can point to DeviceMetric which in turn points to the "logical" Device it belongs to, using [DeviceMetric.source](file:///C:\temp\devicecomponent-definitions.html#DeviceMetric.source).

Devices differ from medications because they are not "used up" - they remain active in a patient in an ongoing fashion. However, the specific boundary between medications and devices is defined at the implementation level and this standard does not enforce a boundary with the exception of devices that are implanted in a patient. The [Medication](file:///C:\temp\medication.html) resource should not be used to represent implanted devices.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\device\device-notes.xml**

**Notes**

**Device Types**

The example binding used for the device element is from SNOMED CT. However, there are many other sources of possible codes for device type including:

* [Global Medical Device Nomenclature (GMDN®)](https://www.gmdnagency.org/)
* [Rosetta Terminology Mapping (RTM)](https://rtmms.nist.gov/rtmms/index.htm)

Note that there may be translations of type code using one or more of these and other vocabularies

**Device Identifiers**

Nearly all devices are assigned one or more identifiers, which are usually printed or affixed to the device using either barcodes or RFIDs. The identifiers can come from the manufacturer (often called the "serial number," "reference number," or "catalog number"), various institution and registries. Any of these identifiers assigned to the device can and should be recorded in the device resource. The different identifiers are differentiated by their use, label, and system values.

**Unique Device Identifier (UDI)**

The International Medical Device Regulators Forum IMDRF UDI Working Group published [UDI System for Medical Devices (Version 2.0)](http://www.imdrf.org/consultations/cons-udi.asp), the base specification for Unique Device Identifiers (UDI). The United States Food and Drug Administration has produced an [implementation guide](http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/UniqueDeviceIdentification/default.htm) for Unique Device Identifiers (UDI) which implements the IMDRF specification and other jurisdictions may produce similar IMDRF implementation guides as well. The full UDI string that represents the barcode as printed on the packaging of the device or Automatic Identification and Data Capture (AIDC) representation is called the "UDI carrier". The UDI has 2 components\*:

* Device identifier (DI)\*\*, which is the actual identification component
* Production identifier(s)(PI) which provide the means to track a device through its manufacture, distribution and use.

\*non-UDI elements may also appear within the UDI carrier. \*\*a "GTIN" (sometimes also called an EAN number) is a code developed by [GS1](http://www.gs1.org/) for the kind of device not an identifier for the device. A GTIN may appear on its own or it may appear in a UDI string as the DI component.

The DI of the UDI may be stored in a jurisdictional repository and used as the primary key to access other device information. For example, in the United States, the DI of the UDI is submitted in a device record to the [Global Unique Device Identification Database (GUDID)](http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/UniqueDeviceIdentification/GlobalUDIDatabaseGUDID/default.htm). the The UDI may identify an instance of a device uniquely (when the PI includes a serial number), or it may just identify the type of the device. The UDI is parsed into its constituent parts (DI, PI and other elements) by parsing rules developed by each Issuing Agency standard. Where the device has an assigned UDI, the other details carried in the resource (e.g., lot, expiriation date, etc.) SHALL be consistent with the information encoded in the UDI string or registered in the local repository.

Best practice guidelines for transmitting UDI data using the Device resource dictate transmitting both the UDI Carrier and all components found within the UDI as described in Device [UDI Mapping](file:///C:\temp\device-mappings.html#udi)). Several [examples](file:///C:\temp\device-examples.html) are provided for futher guidance.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicerequest\devicerequest-examples-header.xml**

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**An introduction to this page as well as proper examples are to be submitted shortly.**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicerequest\devicerequest-introduction.xml**

**Scope and Usage**

**This resource is a *request* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**.**

This resource describes the request for the use of a device by a patient. The device may be any pertinent device specified in the Device resource. Examples of devices that may be requested include wheelchair, hearing aids, or an insulin pump. The request may lead to the dispensing of the device to the patient or for use by the patient.

The device use request may represent an order or a prescription entered by a practitioner in a CPOE system or a proposal made by a clinical decision support (CDS) system based on a patient's clinical record and context of care.

**Boundaries and Relationships**

This resource deals with the allocation of a device to a patient and while it may contain instructions on how to use the device, the data about getting the device to the patient is addressed in other resources. For example, Certain devices must be implanted via a surgical or other procedure and the implantation or explantation is represented in the [Procedure](procedure.html) or [ProcedureRequest](procedurerequest.html) resource.

The SupplyRequest resource is similar in that it deals with requesting a particular item for a specific patient. However, DeviceRequest is concerned with items where there is a patient focus, or instructions regarding their use, whereas SupplyRequest is concerned with inventory management.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\devicerequest\devicerequest-notes.xml**

**Notes to reviewers:**

*At this time, the code bindings are placeholders to be fleshed out upon further review by the community.*

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\deviceusestatement\deviceusestatement-examples-header.xml**

ï»¿

**An introduction to this page as well as proper examples are to be submitted shortly.**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\deviceusestatement\deviceusestatement-introduction.xml**

**Scope and Usage**

**These resources have not yet undergone proper review by PC, CQI, CDS, and OO. At this time, they are to be considered only as draft resource proposals for potential submission.**

**This resource is an *event* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**. It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for**[***event* resources**](file:///C:\temp\workflow.html#event)**.**

This resource records the use of a healthcare-related device by a patient. The record is the result of a report of use by the patient, another provider or a related person. The resource can be used to note the use of an assistive device such as a wheelchair or hearing aid, a contraceptive such an intra-uterine device, or other implanted devices such as a pacemaker.

**Boundaries and Relationships**

This resource is different from DeviceRequest which records a request to use the device. This also is distinct from the Procedure resource which may describe the implantation or explantation of a device.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\deviceusestatement\deviceusestatement-notes.xml**

**Notes to reviewers:**

*At this time, the code bindings are placeholders to be fleshed out upon further review by the community.*

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\diagnosticreport\diagnosticreport-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\diagnosticreport\diagnosticreport-genetics-introduction.xml**

**Overview**

The DiagnosticReport-genetics profile extends the [DiagnosticReport](file:///C:\temp\diagnosticreport.html) resource to enable reporting of structured genetic test results by referring to [Observation-genetics](file:///C:\temp\observation-genetics.html) profile. In addition, the genetics profile denotes condition context for genetic testing, which may influence reported variants and interpretation for large genomic testing panels and provides references to the [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html) resource, the [Condition](file:///C:\temp\condition.html) resource.

For use cases, details on how this resource interact with other Clinical Genomics resources or profiles, please refer to implementation guidance document [here](file:///C:\temp\genomics.html).

**Scope and Usage**

The DiagnosticReport-genetics profile supports reporting of DNA variants at the genomic, cDNA, and protein change level. In addition, a condition context may be provided, as AssessedCondition. For large genomic tests, a condition may be used as an input into the analytic pipeline to aid in the identification of clinically relevant variants related to the test order.

Hl7 Clinical Genomics Work Group emphasizes the importance of transmitting structured genetic findings within the clinical, translational, and research environments fully integrated with other clinical data, in order to drive outcomes analysis, operational decision making, discovery research, and public health reporting.

[Here](https://www.hl7.org/documentcenter/public_temp_65DE7F6D-1C23-BA17-0CB30D7343EDE16D/wg/clingenomics/docs/V3DAM_CG_CLINSEQ_R1_O1_2013JAN.pdf) is the document of HL7 Version 3 Domain Analysis Model where the examples used in genetics profile are from (Page 5).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\diagnosticreport\diagnosticreport-hla-genotyping-results-introduction.xml**

**Overview**

Human leukocyte antigen (HLA) genotyping is fundamental for research and clinical practice in immune-genetics and histocompatibility. Pointers to external locations refer to registered methods, raw NGS reads, and reference standards can be conveyed in this profile. A separate component describing consensus sequences and variants is created specifically to accommodate NGS data (Consensus sequence block profile). Information about and allele assignment is stored in extensions. the NGS genotyping methods still require more work. The structure of HLA typing report in this profile is following: [Histoimmunogenetics Markup Language 1.0: Reporting next generation sequencing-based HLA and KIR genotyping](http://www.ncbi.nlm.nih.gov/pubmed/26319908) and [HLA and KIR NGS Data Information Standard: Final Draft](http://igdawg.org/pubs/20131111_NGS_Data_Standard_draft.pdf).

For use cases, details on how this resource interact with other Clinical Genomics resources or profiles, please refer to implementation guidance document [here](file:///C:\temp\genomics.html).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\diagnosticreport\diagnosticreport-introduction.xml**

**Scope and Usage**

**This resource is an *event* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**. It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for**[***event* resources**](file:///C:\temp\workflow.html#event)**.**

A diagnostic report is the set of information that is typically provided by a diagnostic service when investigations are complete. The information includes a mix of atomic results, text reports, images, and codes. The mix varies depending on the nature of the diagnostic procedure, and sometimes on the nature of the outcomes for a particular investigation. In FHIR, the report can be conveyed in a variety of ways including a [Document](file:///C:\temp\documents.html), [RESTful API](file:///C:\temp\http.html), or [Messaging](file:///C:\temp\messaging.html)framework. Included within each of these, would be the DiagnosticReport resource itself.

The DiagnosticReport resource has information about the diagnostic report itself, and about the subject and, in the case of lab tests, the specimen of the report. It can also refer to the request details and atomic observations details or image instances. Report conclusions can be expressed as a simple text blob, structured coded data or as an attached fully formatted report such as a PDF.

The DiagnosticReport resource is suitable for the following kinds of diagnostic reports:

* Laboratory (Clinical Chemistry, Hematology, Microbiology, etc.)
* Pathology / Histopathology / related disciplines
* Imaging Investigations (x-ray, CT, MRI etc.)
* Other diagnostics - Cardiology, Gastroenterology etc.

The DiagnosticReport resource is not intended to support cumulative result presentation (tabular presentation of past and present results in the resource). The DiagnosticReport resource does not yet provide full support for detailed structured reports of sequencing; this is planned for a future release.

**Background and Context**

**Diagnostic Report Names**

The words "tests", "results", "observations", "panels" and "batteries" are often used interchangeably when describing the various parts of a diagnostic report. This leads to much confusion. The naming confusion is worsened because of the wide variety of forms that the result of a diagnostic investigation can take, as described above. Languages other than English have their own variations on this theme.

This resource uses one particular set of terms. A practitioner "requests" a set of "tests". The diagnostic service returns a "report" which may contain a "narrative" - a written summary of the outcomes, and/or "results" - the individual pieces of atomic data which each are "observations". The results are assembled in "groups" which are nested structures of Observations (traditionally referred to as "panels" or " batteries" by laboratories) that can be used to represent relationships between the individual data items.

**Boundaries and Relationships**

Note that many diagnostic processes are procedures that generate observations and diagnostic reports. In many cases, such an observation does not require an explicit representation of the procedure used to create the observation, but where there are details of interest about how the diagnostic procedure was performed, the [Procedure](file:///C:\temp\procedure.html) resource is used to describe the activity.

In contrast to the [Observation](file:///C:\temp\observation.html) resource, the DiagnosticReport resource typically includes additional clinical context and some mix of atomic results, images, imaging reports, textual and coded interpretation, and formatted representations. Laboratory reports, pathology reports, and imaging reports should be represented using the DiagnosticReport resource. The Observation resource is referenced by the DiagnosticReport to provide the atomic results for a particular investigation.

If you have a highly structured report, then use DiagnosticReport - it has data and workflow support. Details about the request for a diagnostic investigation are captured in the various "request" resources (e.g., the [ProcedureRequest](file:///C:\temp\procedurerequest.html)) resource and allow the report to connect to clinical workflows. For more narrative driven reports with less work flow (histology/mortuary, etc.), the [Composition](file:///C:\temp\composition.html) resource would be more appropriate.

Image and media representations of the report and supporting images are referenced in the DiagnosticReport resource. The details and actual image instances can be referenced directly in Diagnostic report using the "imaging" element or by indirect reference through the [ImagingManifest](file:///C:\temp\imagingmanifest.html) or [ImagingStudy](file:///C:\temp\imagingstudy.html) resources which represent the content produced in a DICOM imaging study or set of DICOM Instances of a patient.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\diagnosticreport\diagnosticreport-notes.xml**

**Notes:**

**Identifiers**

The [identifier](file:///C:\temp\datatypes.html#Identifier) datatype has a type element that may be used to distinguish the identifiers assigned by the requester and the performer of the request (known as the the 'Placer' and 'Filler' in the HL7 Version 2 Messaging Standard). Use the identifier type code "PLAC" for the Placer Identifier and "FILL" for the Filler identifier as is shown in the example below:

<!-- Placer identifier-->

<identifier>

<type>

<coding>

<system value="http://hl7.org/fhir/identifier-type"/>

<code value="PLAC"/>

</coding>

<text value="Placer"/>

</type>

<system value="urn:oid:1.3.4.5.6.7"/>

<value value="2345234234234"/>

</identifier>

<!-- Filler identifier-->

<identifier>

<type>

<coding>

<system value="http://hl7.org/fhir/identifier-type"/>

<code value="PLAC"/>

</coding>

<text value="Placer"/>

</type>

<system value=" http://hl7.org/fhir/identifier-type"/>

<value value="567890"/>

</identifier>

**Clinically Relevant Time**

If the diagnostic procedure was performed on the patient directly, the [effective[x]](file:///C:\temp\diagnosticreport-definitions.html#DiagnosticReport.effective_x_) element is a dateTime, the time it was performed. If specimens were taken, the clinically relevant time of the report can be derived from the specimen collection times, but since detailed specimen information is not always available, and nor is the clinically relevant time always exactly the specimen collection time (e.g. complex timed tests), the reports SHALL always include a effective[x] element. Note that [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) messages often carry a diagnostically relevant time without carrying any specimen information.

**Associated Observations**

* The DiagnosticReport.code always contains the name of the report itself. The report can also contain a set of Observations in the DiagnosticReport.result element. These Observations can be simple observations (e.g. atomic results) or groups/panels of other observations. The Observation.code indicates the nature of the observation or panel (e.g. individual measure, organism isolate/sensitivity or antibody functional testing). When relevant, the observation can specify a particular specimen from which the result comes.
  + Examples of nesting groups/panels within an observation include reporting a "profile" consisting of several panels as is shown in [this example](file:///C:\temp\diagnosticreport-example-ghp.html), a group of antibiotic isolate/sensitivities for a bacterial culture, or a set of perinatal measurements on a single fetus.
  + There is rarely a need for more than two levels of nesting in the Observation tree. One known use is for organism sensitivities - an example of a [complex Micro Isolate and Sensitivities](file:///C:\temp\diagnosticreport-micro1.html) is provided.

**Associated Images**

ImagingStudy and ImageObjectStudy and the DiagnosticReport.image element are somewhat overlapping - typically, the list of image references in the image element will also be found in one of the imaging study resources. However each caters to different types of displays for different types of purposes. Neither, either, or both may be provided.

**Diagnostic Report Status**

* Applications consuming diagnostic reports must take careful note of updated (revised) reports, and ensure that retracted reports are appropriately handled.
* For applications providing diagnostic reports, a report should not be final until all the individual data items reported with it are final or appended.
* If the report has been withdrawn following a previous final release, the DiagnosticReport and associated Observations should be retracted by replacing the status codes with the concept "entered-in-error", and setting the conclusion/comment (if provided) and the text narrative to some text like "This report has been withdrawn" in the appropriate language. A reason for retraction may be provided in the narrative.

**Report Content**

Typically, a report is either:all data, no narrative (e.g. Core lab) or a mix of data with some concluding narrative (e.g. Structured Pathology Report, Bone Density), or all narrative (for example a typical imaging report, histopathology). This resource provides for these 3 different presentations:

* As atomic data items: a hierarchical set of nested references to Observation resources often including pathologist/radiologist interpretation(s), one or more images, and possibly with a conclusion and/or one or more coded diagnoses
* As narrative: an XHTML presentation in the standard resource narrative
* As a "presented form": A rich text representation of the report - typically a PDF

Note that the conclusion and the coded diagnoses are part of the atomic data, and SHOULD be duplicated in the narrative and in the presented form if the latter is present. The narrative and the presented form serve the same function: a representation of the report for a human. The presented form is included since diagnostic service reports often contain presentation features that are not easy to reproduce in the HTML narrative. Whether or not the presented form is included, the narrative must be a clinically safe view of the diagnostic report; at a minimum, this could be fulfilled by a note indicating that the narrative is not proper representation of the report, and that the presented form must be used, or a generated view from the atomic data. However consumers of the report will best be served if the narrative contains clinically relevant data from the form. Commonly, the following patterns are used:

* Simple Laboratory Reports: A single set of atomic observations, and a tabular presentation in narrative. Typically this is encountered in high volume areas such as Biochemistry and Hematology
* Histopathology Report: A document report in a presented form and the narrative. Possibly a few key images, and some coded diagnoses for registries. If the service is creating a structured report, some atomic data may be included
* imaging Report; A document report in a presented form and the narrative, with an imaging study reference and possibly some key images. Some imaging reports such as a Bone Density Scan may include some atomic data

Note that the nature of reports from the various disciplines that provide diagnostic reports are changing quickly, as expert systems provide improved narrative reporting in high volume reports, structured reporting brings additional data to areas that have classically been narrative based, and the nature of the imaging and laboratory procedures are merging. As a consequence the patterns described above are only examples of how a diagnostic report can be used.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\nutritionorder\nutritionorder-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\nutritionorder\nutritionorder-introduction.xml**

**Scope and Usage**

**This resource is a *request* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**. It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for**[***request* resources**](file:///C:\temp\workflow.html)**.**

The NutritionOrder resource describes a request for oral diets (including general diets such as General Healthy diet, or therapeutic diets such as Consistent Carbohydrate, 2 gram Sodium, or Fluid Restricted), oral nutrition supplements (such as nutritionally complete pre-packed drinks), enteral nutrition (tube feedings) and infant formula which govern the distribution of food and nutritional products used to feed patients within an in-patient setting. It does not cover orders for parenteral (IV) nutrition which are typically filled by pharmacy. These nutrition orders are combined with information on a patient's food allergies and intolerances, and ethnic or cultural food preferences (e.g. Kosher or Vegetarian) to inform healthcare personnel about the type, texture, and/or quantity of foods that the patient should receive or consume.

Enteral orders are distinguished from supplements because they have some unique attributes and typically include administration information whereas oral nutritional supplements may simply be supplied (e.g. home health or outpatient settings). In a simple case, the requestor may designate type of product, product name and the route of administration along with free text instructions without a having to complete the additional structured details.

This resource is intended to be used by providers from a variety of specialties such as physicians, dietitian/nutritionists, or speech therapists. One provider may simply order a base element oral diet such as General Healthful diet. Another provider, based on scope of practice, may use other elements to communicate additional therapeutic needs or patient preferences. The optionality included gives an ordering provider the capability to write a simple order for an oral diet, nutritional supplement or formula with minimal requirements beyond that of specifying the diet, supplement or formula product, but also supports the ability to provide more detailed information that may be further augmented by a dietitian or nutrition specialist. For example, a physician may order a 2 g sodium diet. A speech therapist, based on the results of a swallowing evaluation, then orders a mechanically altered texture with nectar thick liquids.

**Boundaries and Relationships**

The NutritionOrder resource is used for requesting oral diets, oral nutrition supplements and enteral feedings in an in-patient setting. The [MedicationRequest](file:///C:\temp\medicationrequest.html) resource should be used for requesting parenteral (IV) nutrition and prescribing dietary supplements such as vitamin or mineral supplements.

The Nutrition Order is a record of the request for the supply of a diet, oral supplement or enteral formulas for a patient. However, to initiate the request requires the use of the [Task](file:///C:\temp\task.html) resource and its associated workflow with the Nutrition Order referenced from Task.basedOn, or by using the Nutrition Task resource in the context of a messaging or service workflow where the request is explicit or implicit.

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**Notes:**

**Enteral continuous vs. intermittent tube feedings**

Tube feedings can be administered via continuous drip using a pump or via intermittent feedings, using gravity drip or a pump. The examples [Nutrition Order Enteral Bolus Feeding Example](file:///C:\temp\nutritionorder-example-enteralbolus.html) and [Nutrition Order Enteral Continuous Feeding Example](file:///C:\temp\nutritionorder-example-enteralcontinuous.html) show how this resource can be used to order both kinds of enteral feeding using the structured data elements. The continuous feeding typically specifies rate of administration and a maximum volume of delivery using the enteralFormula.rate and enteralFormula.maxVolumeToDeliver elements. On the other hand, the intermittent feeding typically specifies the amount and frequency of administration using the enteralFormula.quantity and enteralFormula.schedule elements. In both cases, to vary the rate or quantity over time the enteralFormula.administration element can be repeated.

**Note about the examples**

The examples associated with this resource demonstrate the core elements and do not necessarily reflect real world implementations that may be constrained by future profiles for a given implementation or setting. For example, a renal diet is often comprised of pre-coordinated components including common nutrient modifications such as protein, potassium and phosphorus to assist with the speed of entry of complex diet orders.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-consensus-seq-block-introduction.xml**

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**Overview**

Another profile is created for variants and consensus sequence in HLA typing report on top of the Observation resource. The variant extension referring to the Sequence resource has multiple values so this profile can support multi-variant.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-consensus-sequence-block-introduction.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-device-metric-profile-introduction.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-device-metric-profile-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-devicemetricobservation-profile-introduction.xml**

**Scope and Usage**

The DeviceMetricObservation profile describes the direct or derived, qualitative or quantitative physiological measurement, setting, or calculation data produced by a medical device or a device component.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-devicemetricobservation-profile-notes.xml**

For the initial scope, this DeviceMetricObservation profile is only applicable to describe a measurement that is produced by any medical device that implements or derives from the ISO/IEEE 11073 standard.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-genetics-introduction.xml**

**Overview**

Observation-genetics-profile extends [Observation](file:///C:\temp\observation.html) resource to enable reporting of structured genetic test results. In addition, the genetics profile contextualizes well established standards from the field of clinical genetics into the standards of healthcare (e.g. HGNC - HUGO Gene Nomenclature Committee's international standard for gene names, symbols, and identifiers).

For use cases, details on how this resource interact with other Clinical Genomics resources or profiles, please refer to implementation guidance document [here](file:///C:\temp\genomics.html).

**Genetic Standards and Resources include:**

* Variant Databases: [dbSNP](http://www.ncbi.nlm.nih.gov/projects/SNP/snp_ref.cgi) , [ClinVar](http://www.ncbi.nlm.nih.gov/clinvar/), and [COSMIC](http://cancer.sanger.ac.uk/cosmic/)
* Reference Sequences: [RefSeq](http://www.ncbi.nlm.nih.gov/refseq/) and [ENSEMBL](http://www.ensembl.org/index.html)
* Gene Symbols and Identifiers: [HGNC](http://www.genenames.org) - Human Genee Nomenclature Committee
* Variant Nomenclature: [HGVS](http://www.hgvs.org) nomenclature from the Human Genome Variantion Society
* Locus: [Gene](http://www.ncbi.nlm.nih.gov/gene)

**Scope and Usage**

The Observation-genetics profile supports reporting of a DNA variant at the genomic, cDNA, and protein change level. In addition, a condition context may be provided, as AssessedCondition. For large genomic tests, a condition may be used as an input into the analytic pipeline to aid in the identification of clinically relevant variants related to the test order. It is strongly encouraged to provide all available information in this profile for any reported variants, because receiving systems (e.g. discovery research, outcomes analysis, and public health reporting) may use this information to normalize variants over time or across sources. However, these data should not be used to dynamically correct/change variant representations for clinical use outside of the laboratory, due to insufficient information.

Implementers should be aware that semantic equivalency of results of genetic variants cannot be guaranteed unless there is an agreed upon standard between sending and receiving systems.

This FHIR genomics work is based on work of the HL7 Clinical Genomics Workgroup and modeled based on the Domain Analysis Model and SMART on FHIR Genomics as published in JAMIA 2015 (http://jamia.oxfordjournals.org/content/early/2015/07/21/jamia.ocv045.long).

The HL7 Clinical Genomics Work Group emphasizes the importance of transmitting structured genetic findings within the clinical, translational, and research environments fully integrated with other clinical data, in order to drive outcomes analysis, operational decision making, discovery research, and public health reporting. The standard doesn't currently cover the reporting of clinically relevant negative or wild type results within genetic data portion of the message.

[Here](https://www.hl7.org/documentcenter/public_temp_65DE7F6D-1C23-BA17-0CB30D7343EDE16D/wg/clingenomics/docs/V3DAM_CG_CLINSEQ_R1_O1_2013JAN.pdf) is the document of HL7 Version 3 Domain Analysis Model where the examples used in genetics profile are from (Page 5).

**Interpretation**

Extension - geneticsInterpretation points to an Observation entity. In this Observation entity, Observation.component is used for recording clinical interpretations for variation.

Here is a LOINC panel that could be supported by Observation.component:

|  |  |  |
| --- | --- | --- |
| LOINC Codes | | |
| **LOINC #** | **Component** | **Description/Comments** |
| 51963-7 | Medication Assessed | A coded medication accessed in a pharmacogenetic test (recommend RxNorm). |
| 51964-5 | Drug Efficacy Analysis Overall Interpretation | Overall predicted phenotype for drug efficacy for all DNA Sequence Variations identified in a single case. LOINC Answer List values can be seen in table below. |
| 51967-8 | Genetic disease assessed | A coded disease which is associated with the region of DNA covered by the genetic test (recommend SNOMED). |
| 51969-4 | Genetic analysis summary report | Narrative report in disease diagnostic-based format, which is used for pharmacogenomic reporting as well and disease risk or diagnosis. These reports currently follow the same formatting recommendations. |
| 51971-0 | Drug metabolism analysis overall interpretation | Overall predicted phenotype for drug metabolism for all DNA Sequence Variations identified in a single case. LOINC Answer List values can be seen in table below. |
| 53039-4 | Genetic Disease Analysis Overall Carrier Interpretation | Carrier Identification interpretation of all identified DNA Sequence Variations along with any known clinical information for the benefit of aiding clinicians in understanding the results overall. LOINC Answer List values can be seen in table below. |

|  |  |  |  |
| --- | --- | --- | --- |
| LOINC Answer Lists | | | |
| **LOINC Code** | **Sequence** | **Answer text** | **LOINC answer code** |
| 51964-5 | 1 | Responsive | LA6677-4 |
| 2 | Resistant | LA6676-6 |
| 3 | Negative | LA6577-6 |
| 4 | Inconclusive | LA9663-1 |
| 5 | Failure | LA9664-9 |
| 51971-0 | 1 | Ultrarapid metabolizer | LA10315-2 |
| 2 | Extensive metabolizer | LA10316-0 |
| 3 | Intermediate metabolizer | LA10317-8 |
| 4 | Poor metabolizer | LA9657-3 |
| 5 | Inconclusive | LA9663-1 |
| 53039-4 | 1 | Carrier | LA10314-5 |
| 2 | Negative | LA6577-6 |
| 3 | Inconclusive | LA9663-1 |
| 4 | Failure | LA9664-9 |

In addition, in this Observation entity, Observation.related is used to link itself with Observation-genetics profile. Observation.related.type is 'derived-from' as it provides clinical interpretation for variation recoreded in Observation-genetics entity.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-introduction.xml**

**Scope and Usage**

This resource is an [*event resource*](file:///C:\temp\workflow.html#event) from a FHIR workflow perspective - see [Workflow](file:///C:\temp\workflow.html).

Observations are a central element in healthcare, used to support diagnosis, monitor progress, determine baselines and patterns and even capture demographic characteristics. Most observations are simple name/value pair assertions with some metadata, but some observations group other observations together logically, or even are multi-component observations. Note that the [DiagnosticReport](file:///C:\temp\diagnosticreport.html) resource provides a clinical or workflow context for a set of observations and the Observation resource is referenced by DiagnosticReport to represent lab, imaging, and other clinical and diagnostic data to form a complete report.

Uses for the Observation resource include:

* Vital signs such as [body weight](file:///C:\temp\observation-example.html), [blood pressure](file:///C:\temp\observation-example-bloodpressure.html), and [temperature](file:///C:\temp\observation-example-f202-temperature.html)
* Laboratory Data like [blood glucose](file:///C:\temp\observation-example-f001-glucose.html), or an [estimated GFR](file:///C:\temp\observation-example-f205-egfr.html)
* Imaging results like [bone density](file:///C:\temp\observation-example-bmd.html) or fetal measurements
* Devices Measurements such as [EKG data](file:///C:\temp\observation-example-sample-data.html) or [Pulse Oximetry data](file:///C:\temp\observation-example-satO2.html)
* Clinical assessment tools such as [APGAR](file:///C:\temp\observation-example-5minute-apgar-score.html) or a [Glasgow Coma Score](file:///C:\temp\observation-example-glasgow.html)
* Personal characteristics: such as [eye-color](file:///C:\temp\observation-example-eye-color.html)
* Social history like tobacco use, family support, or cognitive status
* Core characteristics like pregnancy status, or a death assertion

**Core Profiles for Observation**

The following core [profiles](file:///C:\temp\profiling.html) for the Observation resource have been defined as well. If implementations use this Resource when expressing the profile-specific concepts as structured data, they **SHALL** conform to the following profiles:

| **Profile** | **Description** |
| --- | --- |
| [Vital signs](file:///C:\temp\observation-vitalsigns.html) | The FHIR Vital Signs profile sets a minimum expectations for the Observation Resource to record, search and fetch the vital signs (e.g. temperature, blood pressure, respiration rate, etc) associated with a patient |

**Boundaries and Relationships**

In contrast to the Observation resource, the [DiagnosticReport](file:///C:\temp\diagnosticreport.html) resource typically includes additional clinical context and some mix of atomic results, images, imaging reports, textual and coded interpretation, and formatted representations. Laboratory reports, pathology reports, and imaging reports should be represented using the DiagnosticReport resource. The Observation resource is referenced by the DiagnosticReport to provide the atomic results for a particular investigation.

"Laboratories routinely have a variable that is summative across a series of discrete variables - these are usually called 'impressions' or 'interpretations'. Sometimes they are algorithmically specified and sometimes they have the imprimatur of pathologists and they are conveyed in Observation or DiagnosticReport instead of the [Clinical Impression](file:///C:\temp\clinicalimpression.html) resource. However, the Observation resources should not be used to record clinical diagnosis about a patient or subject that are typically captured in the [Condition](file:///C:\temp\condition.html) resource or the ClinicalImpression resource.

The Observation resource is often referenced by the Condition resource to provide specific subjective and objective data to support its assertions. There are other resources that can be considered "specializations" of the Observation resource and should be used for those specific contexts and use cases. They include [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) resource, [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html) resource, [Procedure](file:///C:\temp\procedure.html) resource, and [Questionnaire](file:///C:\temp\questionnaire.html) resource. In some cases, such as when source data is coming from an [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) feed, a system may not have information that allows it to distinguish diagnosis, allergy and other "specialized" types of observations from lab, vital sign and other observation types intended to be conveyed with this resource. In those circumstances, such specialized observations may also appear using this resource.

The [Media](file:///C:\temp\media.html) resource captures a specific type of observation whose value is audio, video or image data. This resource is the preferred representation of such forms of information as it exposes the metadata relevant for interpreting the information. However, in some implementations, media information may appear in Observation susing the valueAttachment element and systems should be aware of this possibility.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-notes.xml**

**Notes:**

At its simplest, a resource instances can consist of only a code and a value, and status flag. The relevance of other properties will vary based on the type of observation.

[Profiles](file:///C:\temp\observation-profiles.html) will be created to provide guidance on capturing certain types of simple observations. This resource focuses on the level of detail captured by most systems. However, any "simple" observation can easily be broken into numerous components and sub-components to provide additional information relevant in certain circumstances. As with other resources, [extensions](file:///C:\temp\extensibility.html) can be used to introduce this additional complexity.

**Observation Grouping**

Many observations have important relationships to other observations and need to be grouped together. Three structures have been defined to do this: DiagnosticReport and DiagnosticReport.result, Observation and Observation.component, and Observation and Observation.related. The table below provides guidance around which structure to use. Because the idea of what to group together is often highly contextual and based upon the end user's point of view, the choice of which structure to use will be driven by jurisdiction, organizational practice and context. Profiling will normally be necessary for implementation.

| **DiagnosticReport and DiagnosticReport.result** | **Observation and Observation.component** | **Observation and Observation.related** |
| --- | --- | --- |
| DiagnosticReport relates directly to an order (ProcedureRequest). The DiagnosticReport.code names the panel and serves as the grouping element, which is traditionally referred to as a "panel" or "battery" by laboratories. The DiagnosticReport.result element references the individual observations. Several [examples](file:///C:\temp\diagnosticreport-examples.html) demonstrate observation grouping using DiagnosticReport as the grouping structure. | Observation.component is used for any supporting result that cannot reasonably be interpreted and used outside the scope of the Observation it is a component of. Components should only be used when there is only one method, one observation, one performer, one device, and one time. For example, systolic and diastolic blood pressure are represented as a single Observation (e.g. [Blood pressure panel](file:///C:\temp\observation-example-bloodpressure.html)) because the two are almost always produced and interpreted together. Note that the component.code may in some cases only be able to be understood in relation to the Observation.code (for example, see the [$stats operation](file:///C:\temp\observation-operations.html#10.1.20.1)). | Observation.related is used for any supporting result that can be interpreted and used on its own and has one or more different values for method, observation, performer, device, time, and/or error conditions. The top level observation specifies the grouping code in Observation.code, but typically does not have its own Observation.value, and the set of member observations are listed in the Observation.related element. This structure permits *nested grouping* when used with DiagnosticReport (e.g. [complex micro isolate and sensitivities report](file:///C:\temp\diagnosticreport-micro1.html)). |

**Value[x] and Datatypes**

* The element, Observation.value[x], has a variable name depending on the type as follows:
  + valueQuantity
  + valueCodeableConcept
  + valueString
  + valueBoolean
  + valueRange
  + valueRatio
  + valueSampledData
  + valueAttachment
  + valueTime
  + valueDateTime
  + valuePeriod
* **Using codes for result values**

When a result value is a represented as a predefined concept using a code, valueCodeableConcept is used. This element is [bound](file:///C:\temp\terminologies.html) to a value set comprised of a standard nomenclature such as SNOMED CT or a source system ("local") coded result values. Results may be coded in multiple value sets based on different code systems and these may be mapped using the [ConceptMap](file:///C:\temp\conceptmap.html) resource and/or given as translations directly in the element as shown in the example below.

For example the LOINC 43304-5 *Chlamydia trachomatis rRNA [Presence] in Unspecified specimen by Probe and target amplification method* is typically associated with coded presence/absence concepts. Using the coded value for 'negative' with a standard code translation, valueCodeableConcept would be:

"valueCodeableConcept": {

"coding": [

{

"system": "http://snomed.info/sct",

"code": "260385009",

"display": "Negative"

},

{

"https://acme.lab/resultcodes",

"code": "NEG",

"display": "Negative"

}

],

"text": "Negative for Chlamydia Trachomatis rRNA"

}

Text values for coded results:

When the data element is usually coded or the type associated with the code element defines a coded value, use valueCodeableConcept *even* if there is no appropriate code and only uncoded text is available. For example using text only, the valueCodeableConcept element the would be:

"valueCodeableConcept": {

"text": "uncoded free text result"

}

When a coded answer list includes a concept code for "other" and there is a free text description of the concept, the valueCodeableConcept.text element should be used to capture the full meaning of the source. In the example below, the answer code "Other" is provided in the valueCodeableConcept element and the text value supplied value in the CodeableConcept.text element.

{

"resourceType": "Observation",

"code": {

"coding": [{

"system": "http://loinc.org",

"code": "74076-1",

"display": "Medication or substance involved"

}]

},

"valueCodeableConcept": {

"coding": [{

"system": "http://loinc.org",

"code": " LA20343-2",

"display": "Other substance: PLEASE SPECIFY"

}],

"text": "Other: Blue pills I found under my couch"

}

}

* The Boolean data type is rarely used for value[x] because most observations result values are never truly Boolean due to exceptional values such as "unknown", therefore they should use the CodeableConcept data type instead.
* The special values "E" (error), "L" (below detection limit) and "U" (above detection limit) can be used are in the SampledData data type. However when using valueQuantity in an observation for above and below detection limit values, valueQuantity should be used by stating the limit along with the comparator. In addition, when there is an error the dataAbsentReason element should be used with the appropriate value ( 'error' or 'NaN'). For example if the value was below the lower limit of detection of <2.0 mmol/L the valueQuantity would be:
* "valueQuantity": {
* "value": 2.0,
* "comparator" : "<",
* "unit": "mmol/l",
* "system": "http://unitsofmeasure.org",
* "code": "mmol/L"
* }

If the value was "NaN" (i.e. an error) the valueCodeableConcept element would be absent and dataAbsentReason element would be:

"dataAbsentReason": {

"coding": [

{

"system": "http://hl7.org/fhir/data-absent-reason",

"code": "NaN",

"display": "Not a Number"

}

* Because there are multiple types allowed for the *value* element, multiple value search parameters are defined. There is no standard parameter for searching values of type Attachment, or Ratio

**Physiologically Relevant Time of the Observation**

The effectiveDateTime or effectivePeriod is the time that the observation is most relevant as an observation of the subject. For a biological subject (e.g. a human patient), this is the physiologically relevant time of the observation. In the case of an observation using a specimen, this represents the start and end of the specimen collection (e.g. 24 hour Urine Sodium), but if the collection time is sufficiently short, this is reported as a point in time value (e.g. normal venipuncture). In the case of an observation obtained directly from a subject (e.g. BP, Chest X-ray), this is the start and end time of the observation process, which again, is often reported as a single point in time.

**Reference Range**

Most commonly observations will only have one generic reference range. Reference ranges may be useful for lab tests and other measures like systolic blood pressure, but will have little relevance for something like "pregnancy status". Systems MAY choose to restrict to only supplying the relevant reference range based on knowledge about the patient (e.g. specific to the patient's age, gender, weight and other factors), but this may not be possible or appropriate. Whenever more than one reference range is supplied, the differences between them SHOULD be provided in the reference range and/or age properties.

**Canceled or Aborted Observations**

If a measurement or test could not be completed (for example if the specimen is unsatisfactory or the provider cancelled the order), then the status value should be updated to "canceled" and the specific details given - preferably as coded values in the dataAbsentReason or valueCodeableConcept element. Additional information may provided in comments as well. The [specimen reject example](file:///C:\temp\observation-example-unsat.html) demonstrates this using a coded value for unsatisfactory specimen in dataAbsentReason.

**Operations defined for Observation**

**Searching for the Last N Observations**

The *lastn* query operation meets the common need for searching for the most recent or "last known" Observations for a subject. Examples where this query could be used:

* Fetch the last 5 temperatures for a patient to view trends
* Get the most recent lab results for patient
* Fetch the last 3 results for all vitals for a patient

See the [Last N Observations Query](file:///C:\temp\observation-operations.html#10.1.20.2) section in the Observation resource operations page for more information and examples

**Retrieving Statistics for Laboratory Observations**

The *stats* operation performs a set of statistical calculations on a set of clinical measurements such as a blood pressure as stored on the server. This operation is focused on Observation resources with valueQuantity elements that have UCUM unit codes. Examples where this operation could be used:

* Get the average, min, max and count of a series of BP measurements for a patient
* Determine 20th or 80th percentile on a set of measurements over a time period

See the [Observation Statistics](file:///C:\temp\observation-operations.html#10.1.20.1) section in the Observation resource operations page for more information and examples

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-vitalsigns-profile-introduction.xml**

**Introduction**

Vital signs will be one of the first areas where there is a need for a single, global vocabularly to allow for ubiquitous access and re-use. Particularly with the use of wearables by patients where they want to/need to share information from those devices. To meet this need there must be a consistent vocabulary and a common syntax to achieve semantic interoperability. The FHIR Vitals Signs profile sets a minimum expectations for the Observation Resource to record, search and fetch the vital signs associated with a patient that include the primary vitals signs plus additional measurements such as height weight and BMI. Support for basic mandatory searching of resources are defined below in the [Quick Start](file:///C:\temp\intros%20and%20notes.html#Quick_Start) section. When a FHIR implementation supports any of the vital signs listed below, the implementation **SHALL** conform to this profile for the vitals sign observation.

These requirements were originally developed, balloted, and published in FHIR DSTU2 as part of the ONC sponsored [Data Access Framework (DAF)](http://wiki.siframework.org/Data+Access+Framework+Homepage) project and were subsequently updated to define the minimum mandatory conformance requirements needed for accessing patient data as defined by the [Argonaut](http://argonautwiki.hl7.org/index.php?title=Main_Page) pilot implementations.

**Scope and Usage**

**Example Usage Scenarios:**

The following are example usage scenarios for this profile profile:

* Query for vital signs of a particular patient

**Mandatory Data Elements and Terminology**

The following data-elements are mandatory (i.e data MUST be present). These are presented below in a simple human-readable explanation. Profile specific guidance and valid examples are provided as well. Note that many of the examples capture more that the minimum required. The links to the [**Profile Definitions**](file:///C:\temp\intros%20and%20notes.html#content) provide the formal views of the profile content, descriptions, mappings and the StructureDefinitions in JSON and XML.

**Each Observation must have:**

1. a status
2. a category code of 'vital-signs'
3. a "magic value" which tells you what is being measured
   * LOINC was chosen for the "magic values" because this aligns with the most countries. But it can be treated as simply a fixed core set of common codes to communicate basic vital signs. Implementers that need to use a different code system can still map accordingly.
4. a patient
5. a time indicating when the measurement was taken
6. a numeric result value and standard UCUM unit which is taken from the Unit Code column in the table below.
   * note: if there is no numeric result then you have to supply a reason

**Formal View of Profile Content**

[Vital Signs Profile](file:///C:\temp\vitalsigns.html) : Link to the formal definition views for the vital signs listed in this table.

* The table below represents a minimum set of vital sign concepts , the required codes ("magic values"), and UCUM units of measure codes used for representing vitals signs observations. These are [extensible](file:///C:\temp\terminologies.html#extensible) bindings and require that when a system supports of any of these vital signs concepts, they must represent them using these codes. In addition, if you have a blood pressure observation, you must have both a systolic and a diastolic component, though one or both may have dataAbsentReason instead of a value.
* The first column of this table links to the formal views of the individual profile for each vital sign.
* If a more specific code or another code system is recorded or required, implementers must support both the values (LOINC) listed below and the translated code - e.g. method specific LOINC Codes, SNOMED CT concepts, system specific (local) codes.
* In addition the implementer may choose to provide alternate codes in addition to the standard codes defined here. The examples illustrate using other codes as translations.
* Other profiles may make rules about which vital sign must be present or must be present as part of a panel or expand the list to include other vital sign. For implementers using LOINC, optional qualifier codes are provided in the notes below.

| **Profile Name** | **"Magic Value" (LOINC)** | **LOINC Name and Comments** | **UCUM Unit Code** | **Examples** |
| --- | --- | --- | --- | --- |
| [Vital Signs Panel](file:///C:\temp\vitalspanel.html) | 85353-1 | *Vital signs, weight, height, head circumference, oxygen saturation and BMI panel* - It represent a panel of vital signs listed in this table. All members of the panel are optional and note that querying for the panel may miss individual results that are not part of the actual panel. When used, Observation.valueQuantity is not present ; instead, related links (with type=has-member) reference the vital signs observations (e.g. respiratory rate, heart rate, BP, etc). Note that querying for the panel may miss individual results that are not part of an actual panel. This code replaces the deprecated code 8716-3 - *Vital signs* which is used in the Argonaut Data Query Implementation Guide. | - | [Vital Signs Panel Example](file:///C:\temp\observation-example-vitals-panel.html) |
| [Respiratory Rate](file:///C:\temp\resprate.html) | 9279-1 | *Respiratory Rate* | /min | [Respiratory Rate Example](file:///C:\temp\observation-example-respiratory-rate.html) |
| [Heart rate](file:///C:\temp\heartrate.html) | 8867-4 | *Heart rate* - To supplement this vital sign observation, 8887-2 -*Heart rate device type* MAY be used as an additional observation. | /min | [Heart Rate Example](file:///C:\temp\observation-example-heart-rate.html) |
| [Oxygen saturation](file:///C:\temp\oxygensat.html) | 59408-5 | *Oxygen saturation in Arterial blood by Pulse oximetry* - This code replaces the deprecated code 2710-2 -*Deprecated Oxygen saturation in Capillary blood by Oximetry* which had been listed in C-CDA. | % | [Oxygen Saturation Example](file:///C:\temp\observation-example-satO2.html) |
| [Body temperature](file:///C:\temp\bodytemp.html) | 8310-5 | *Body temperature* - o supplement this vital sign observation, 8327-9 - *Body temperature measurement site* (oral, forehead, rectal, etc.) and 8326-1 -*Type of body temperature device* MAY be used as additional observations | Cel, [degF] | [Body Temperature Example](file:///C:\temp\observation-example-body-temperature.html) |
| [Body height](file:///C:\temp\bodyheight.html) | 8302-2 | *Body height* | cm, [in\_i] | [Body height Example](file:///C:\temp\observation-example-body-height.html) |
| [Body length](file:///C:\temp\bodylength.html) | 8306-3 | *Body height --lying* - Like height, but lying down, typically this is used for infants | cm, [in\_i] | [Body Length Example](file:///C:\temp\observation-example-body-length.html) |
| [Head circumference](file:///C:\temp\headcircum.html) | 8287-5 | *Head Occipital-frontal circumference by Tape measure* | cm, [in\_i] | [Head Cirmcumference Example](file:///C:\temp\observation-example-head-circumference.html) |
| [Body weight](file:///C:\temp\bodyweight.html) | 29463-7 | *Body weight* - To supplement this vital sign observation, 8352-7 - *Clothing worn during measure* and 8361-8 - *Body position with respect to gravity* MAY be used as additional observations. | g, kg,[lb\_av] | [Body Weight Example](file:///C:\temp\observation-example.html) |
| [Body mass index](file:///C:\temp\bmi.html) | 39156-5 | *Body mass index (BMI) [Ratio]* | kg/m2 | [Body Mass Example](file:///C:\temp\observation-example-bmi.html) |
| [Blood pressure systolic and diastolic](file:///C:\temp\bp.html) | 85354-9 | *Blood pressure panel with all children optional* - This is a component observation. It has no value in Observation.valueQuantity and contains at least one component (systolic and/or diastolic). To supplement this vital sign observation, 8478-0 - *Mean blood pressure*, 8357-6 - *Blood pressure method*, 41904-4 - *Blood pressure measurement site*, 8358-4 - *Blood pressure device cuff size*, 41901-0 - *Type of blood pressure device* MAY be used as additional observations. | - | [Blood Pressure Example](file:///C:\temp\observation-example-bloodpressure.html),[Blood Pressure Example with missing Diastolic measurement](file:///C:\temp\observation-example-bloodpressure-dar.html) |
| [Systolic blood pressure](file:///C:\temp\bp.html) | 8480-6 | *Systolic blood pressure* - Observation.component code for a blood pressure Observation | mm[Hg] | [Blood Pressure Example](file:///C:\temp\observation-example-bloodpressure.html) |
| [Diastolic blood pressure](file:///C:\temp\bp.html) | 8462-4 | *Diastolic blood pressure* - Observation.component code for a blood pressure Observation | mm[Hg] | [Blood Pressure Example](file:///C:\temp\observation-example-bloodpressure.html) |

**Quick Start**

Below is an overview of required search and read operations

**Clients**

* A client has connected to a server and fetched all of a patient's vital signs by searching by category using GET [base]/Observation?patient=[id]&category=vital-signs.
* A client has connected to a server and fetched all of a patient's vital signs searching by category code and date range using GET [base]/Observation?patient=[id]&category=vital-signs&date=[date]{&date=[date]}.
* A client has connected to a server and fetched any of a patient's vital signs by searching by one or more of the codes listed below using GET [base]/Observation?patient=[id]&code[vital sign LOINC{,LOINC2,LOINC3,...}].
* A client **SHOULD** be capable of connecting to a server and fetching any of a patient's vital signs searching by one or more of the codes listed below and date range using GET [base]/Observation?patient=[id]&code=[LOINC{,LOINC2...}]vital-signs&date=[date]{&date=[date]}.

**Servers**

* A server is capable of returning all of a patient's vital signs that it supports using GET [base]/Observation?patient=[id]&category=vital-signs.
* A server is capable of returning all of a patient's vital signs queried by date range using GET [base]/Observation?patient=[id]&category=vital-signs&date=[date]{&date=[date]}.
* A server is capable of returning any of a patient's vital signs queried by one or more of the codes listed below using GET [base]/Observation?patient=[id]&code[vital sign LOINC{,LOINC2,LOINC3,...}].
* A server **SHOULD** be capable of returning any of a patient's vital signs queried by one or more of the codes listed below and date range using GET [base]/Observation?patient=[id]&code=[LOINC{,LOINC2...}]vital-signs&date=[date]{&date=[date]}.
* A server has ensured that every API request includes a valid Authorization token, supplied via:Authorization: Bearer {server-specific-token-here}
* A server has rejected any unauthorized requests by returning an HTTP 401 Unauthorized response code.

**GET [base]/Observation?patient=[id]&category=vital-signs**

**Example:** Search for all Vitals Signs measurements for a patient

[GET [base]/Observation?patient=1186747&category=vital-signs](file:///C:\temp\intros%20and%20notes.html#.html)

*Support:* Mandatory to support search by category code.

*Implementation Notes:* Search based on vital sign category code. This search fetches a bundle of all Observation resources with category 'vital-signs' for the specified patient [(how to search by reference)](file:///C:\temp\search.html#reference) and [(how to search by token)](file:///C:\temp\search.html#token). The table above is the minimum set, additional vital signs are allowed.

*Response Class:*

* (Status 200): successful operation
* (Status 400): invalid parameter
* (Status 401/4xx): unauthorized request
* (Status 403): insufficient scope

**GET [base]/Observation?patient=[id]&code=[vital sign LOINC{,LOINC2,LOINC3,...}]**

**Example:** Search for all heart rate observations for a patient:

[GET [base]/Observation?patient=1186747&code=8867-4](file:///C:\temp\intros%20and%20notes.html#.html)

**Example:** Search for all heart rate, respiratory rate and blood pressure observations for a patient

[GET [base]/Observation?patient=1186747&code=8867-4,9279-1,55284-4](file:///C:\temp\intros%20and%20notes.html#.html)

*Support:* Mandatory to support search by vital sign LOINC(s) listed above.

*Implementation Notes:* 1)Search based on vital sign LOINC code(s). This fetches a bundle of all Observation resources for specific vital sign(s) listed in the table above for the specified patient [(how to search by reference)](file:///C:\temp\search.html#reference) and [how to search by token)]. 2) The Argonaut Observation "code" parameter has been defined to search both in both Observation.code and Observation.component.code. For example when fetching blood pressures the same resources will be returned whether the search is based on 55284-4(Systolic and Diastolic BP), or the component codes 8480-6(Systolic BP) or 8462-4 (Diastolic BP).

*Response Class:*

* (Status 200): successful operation
* (Status 400): invalid parameter
* (Status 401/4xx): unauthorized request
* (Status 403): insufficient scope

**GET [base]/Observation?patient=[id]&category=vital-signs&date=[date]{&date=[date]}**

**Example:** Find all the blood pressures after 2013-03-14

[GET [base]/Observation?patient=555580&code=55284-4&date=ge2015-01-14](file:///C:\temp\intros%20and%20notes.html#.hml)

*Support:* Mandatory to support search by category code and date

*Implementation Notes:* Search based on vital sign category code and date. This fetches a bundle of all Observation resources with category 'vital-signs' for the specified patient for a specified time period [(how to search by reference)](file:///C:\temp\search.html#reference) and [(how to search by token)](file:///C:\temp\search.html#token).

*Response Class:*

* (Status 200): successful operation
* (Status 400): invalid parameter
* (Status 401/4xx): unauthorized request
* (Status 403): insufficient scope

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\observation\observation-vitalsigns-profile-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\procedurerequest\procedurerequest-examples-header.xml**

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**An introduction to this page as well as proper examples are to be submitted shortly.**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\procedurerequest\procedurerequest-introduction.xml**

**Scope and Usage**

**This resource is a request resource from a FHIR workflow perspective** - see [Workflow](file:///C:\temp\workflow.html).

*ProcedureRequest* is a record of a request for a procedure to be planned, proposed, or performed, as distinguished by the ProcedureRequest.status field value, with or on a patient. Examples of procedures include diagnostic tests/studies, endoscopic procedures, counseling, biopsies, therapies (e.g., physio-, social-, psychological-), (exploratory) surgeries or procedures, exercises, and other clinical interventions. Procedures may be performed by a healthcare professional, a friend or relative or in some cases by the patient themselves. The procedure will lead to either a [Procedure](file:///C:\temp\procedure.html) or [DiagnosticReport](file:///C:\temp\diagnosticreport.html), that in turn may reference one or more observations, that summarizes the performance of the procedures and associated documentation such as observations, images, findings that are relevant to the treatment/management of the subject.

The principal intention of *ProcedureRequest* is to support ordering procedures for on patients (which includes non-human patients in veterinary medicine). However, in many contexts, healthcare related processes include performing diagnostic investigations on groups of subjects, devices involved in the provision of healthcare, and even environmental locations such as ducts, bodies of water, etc. *ProcedureRequest* supports all these usages. The procedure request may represent an order that is entered by a practitioner in a CPOE system as well as a proposal made by a clinical decision support (CDS) system based on a patient's clinical record and context of care. Planned procedures referenced by a [CarePlan](file:///C:\temp\careplan.html) may also be represented by this resource.

The general work flow that this resource facilitates is that a clinical system creates a procedure request. The procedure request is then accessed by or exchanged with a system, perhaps via intermediaries, that represents an organization (e.g., diagnostic or imaging service, surgical team, physical therapy department) that can perform the procedure. The organization receiving the procedure request will, after it accepts the request, update the request as the work is performed, and then finally issue a report that references the requests that it fulfilled.

The *ProcedureRequest* resource allows requesting only a single procedure. If a workflow requires requesting multiple procedures simultaneously, this is done using multiple instances of this resource. These instances can be linked in different ways, depending on the needs of the workflow. For guidance, refer to the [Request pattern](file:///C:\temp\request.html)

**Boundaries and Relationships**

*ProcedureRequest*, [ReferralRequest](file:///C:\temp\referralrequest.html), and [CommunicationRequest](file:///C:\temp\communicationrequest.html) are closely related. In fact, for some services, it may be appropriate to use any one of these resources to request that the procedure be performed. Which one is used may be driven by organization practice and by context. When it is unclear which to use, the following principles may be helpful:

* *ProcedureRequest* is typically used when the requesting clinician has and wishes to exercise the authority (and expertise) to decide exactly what action will be done.
* A ReferralRequest is used when the requesting practitioner is seeking another practitioner or organization to use their own expertise and/or authority to determine the specific action to take.
* A CommunicationRequest is a request to merely disclose information whereas a *ProcedureRequest* is used when an action is considered to be training or counseling - i.e. when the process will involve verification of the patient's comprehension or an attempt to change the patient's mental state.

Irrespective of this guidance, systems should be prepared for some degree of overlap between these resources and be prepared to execute searches against multiple resources in cases where differentiation cannot be guaranteed. In some workflows more than one type of resource might exist. For example, upon receiving a ReferralRequest a practitioner might initiate a *ProcedureRequest*.

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**Notes:**

* Many procedure requests will create a need to specify a specimen or body site or system. The request code will often have this information embedded in it - for example, 'serum glucose' or 'chest xray'. Alternatively, the specimen or bodysite element may be used to specify it.
* The ProcedureRequest should only reference the [Specimen](file:///C:\temp\specimen.html) resource directly when the diagnostic investigation is requested on already existing specimens. Conversely, if the request is entered first with an uncollected specimen, the Specimen resource will reference the DiagnosticRequest resource when it is created.
* The reasonCode element is often for billing purposes. It may relate to the resources referred to in supportinginfo element and may be used to decide how a procedure or diagnostic investigation will be performed, or even if it will be performed at all

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**Scope and Usage**

Any material sample:

* taken from a biological entity, living or dead
* taken from a physical object or the environment

Some specimens are biological and can contain one or more components including but not limited to cellular molecules, cells, tissues, organs, body fluids, embryos, and body excretory products (source: [NCI Thesaurus](http://ncit.nci.nih.gov/), modified).

The specimen resource covers substances used for diagnostic and environmental testing. The focus of the specimen resource is the process for gathering, maintaining and processing the specimen as well as where the specimen originated. This is distinct from the use of Substance which is only used when these other aspects are not relevant.

**Background and Context**

The current definition of the specimen resource contains only basic information about specimen containers. It does not address the recursive nature of containers or the tracking of the location of a container within its parent container (for instance: a tube in a tray in a rack in a freezer). The frequency with which these elements are tracked may depend on the context of use; general lab, biobanking, etc. Comments from reviewers on the appropriate scope for this resource, and the need for tracking related specimen management attributes, are welcomed.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\substance\substance-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\substance\substance-introduction.xml**

**Scope and Usage**

This resource allows for a material to be represented. The resource can be used to represent either a kind of a substance - e.g. a formulation commonly used for treating patients, or it can be used to describe a particular package of a known substance (e.g. bottle, jar, packet).

The composition of the material can be specified in terms of a mix of other materials, including with precise amounts if required.

**Boundaries and Relationships**

A medication is a substance that is packaged and used as an administered medication. The [medication resource](file:///C:\temp\medication.html) uses the substance resource to represent the actual ingredients of a medication.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\supplydelivery\supplydelivery-introduction.xml**

**Scope and Usage**

**This resource is an *event* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**. It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for**[***event* resources**](file:///C:\temp\workflow.html#event)**.**

The scope of the supply resource is for supplies used in the healthcare process. This includes supplies specifically used in the treatment of patients as well as supply movement within an institution (transport a set of supplies from materials management to a service unit (nurse station). This resource does not include the provisioning of transportation services.

**Boundaries and Relationships**

This resource overlaps with others such as [Device](file:///C:\temp\device.html) and [Medication](file:///C:\temp\medication.html). The **Supply** resource may be used to describe medications and devices when handling them generically (as any other supply). For example, when processing bulk orders, etc. However, when the medication, device or other aspects of the resource are important, (e.g. in a [MedicationRequest](file:///C:\temp\medicationrequest.html) or when identifying a device as a performer), the more detailed resource must be used.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\supplyrequest\supplyrequest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\supplyrequest\supplyrequest-introduction.xml**

**Scope and Usage**

**This resource is a *request* resource from a FHIR workflow perspective - see**[**Workflow**](file:///C:\temp\workflow.html)**. It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for**[***request* resources**](file:///C:\temp\workflow.html)**.**

The scope of the SupplyRequest resource is for recording the request of supplies used in the healthcare process. This includes supplies specifically used in the treatment of patients as well as supply movement within an institution (transport a set of supplies from materials management to a service unit (nurse station). This resource does not include the provisioning of transportation services.

The SupplyRequest resource allows requesting only a single item. If a workflow requires requesting multiple items simultaneously, this is done using multiple instances of this resource. These instances can be linked in different ways, depending on the needs of the workflow. For guidance, refer to [the Request pattern](file:///C:\temp\request.html#compound)

**Boundaries and Relationships**

Note that the SupplyRequest records the fact that a request was made. To actually act on that request, additional workflow beyond simply the existence of a SupplyRequest is required. This can be achieved by using an [Task](file:///C:\temp\task.html) resource, with the SupplyRequest referenced from the Task.focus, or by using the SupplyRequest resource in the context of an messaging or service workflow where the request is explicit or implicit. The [SupplyDelivery](file:///C:\temp\supplydelivery.html) resource represents the fulfillment as a result of SupplyRequest being acted upon.

The SupplyRequest resource is used for *inventory management*. When requesting medication, substances and devices when there is a patient focus or instructions regarding their use, [DeviceRequest](file:///C:\temp\devicerequest.html) or [MedicationRequest](file:///C:\temp\medicationrequest.html) should be used instead

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**Scope and Usage**

A task resource describes an activity that can be performed and tracks the state of completion of that activity. It is a representation that an activity should be or has been initiated, and eventually, represents the successful or unsuccessful completion of that activity.

Note that there are a variety of processes associated with making and processing orders. Some orders may be handled immediately by automated systems but most require real world actions by one or more humans. Some orders can only be processed when other real world actions happen, such as a patient actually presenting themselves so that the action to be performed can actually be performed. Often these real world dependencies are only implicit in the order details.

**Background and Context**

**Using Tasks in a RESTful context**

In a RESTful context, a server functions as a repository of tasks. The server itself, or other agents are expected to monitor task activity, and initiate appropriate actions to ensure task completion, updating the status of the task as it proceeds through its various stages of completion. These agents can be coordinated, following well choreographed business logic to ensure that tasks are completed. Task management may also be centrally controlled using some form of workflow engine, in which case, the workflow engine itself may update and maintain the task resources in the server, and through its orchestration activities, ensure that tasks are completed. The task resource enables either model of task management, yet provides a consistent view of the status of tasks being executed in support of healthcare workflows.

The assignment of tasks into categories by type of task and type of performer, and task status enable the server to function as a queue of work items. This queue can be polled or subscribed to by various agents, enabling automation of workflows in FHIR using existing search and subscription mechanisms. Owners, requesterss, other agents (e.g. workflow managers) can thus be ready to initiate the next steps in a complex workflow.

**Tasks State Machine**

Tasks start in a Created state. Once they have been assigned to an owner they transition to the Ready state, indicating that they are ready to be performed. Once the owner initiates activity on the task, the task transitions to the In Progress state, indicating that work is being performed. Upon normal completion, the task enters the Completed state. If there is a failure during the task execution that prevents the task from being completed, it can also enter a Failed state, indicating an abnormal termination of the task. A task in any non-terminal state may also be Cancelled, representing an abnormal termination of the task due to external forces, rather than an error condition.

Tasks in any non-terminal state (Created, Reading, In Progress) can be suspended and resumed. When a task is suspended, it is typically resumed in the state it was in when it was originally suspended. Suspending a task suspends all of its children as well. Resuming a task resumes all of its children.

An In-progress task can also be stopped, returning it to a ready state. This may be in preparation for delegation or reassignment (e.g., because it cannot be completed by the current owner), to restart a task due to a temporary failure (e.g., to reattempt completion of the activity), or in preparation to allow others to claim the task.

**Using Tasks with operations**

The Task resource defines several operations to enable rich control over the task execution environment. A server managing task resources may allow unfettered read access to all tasks that it maintains, but restrict write access to the task resources to itself in order to exert control over the task state machine. Instead, it might offer operations on tasks that enable strictly controlled write operations following commonly accepted business rules for task management. For example, only tasks that are in the "In Process" state might be allowed to be "Completed" or "Failed". Use or support of these operations is not essential in simple workflow environments where task activity needs little management.

There is no distinct operation for creating a new task because the FHIR RESTful API already distinguishes between the create and update operations.

The task history allows applications monitoring the state of a workflow to identify tasks that are long running, perhaps stuck in some queue, to enable management activities that could ensure completion. It also enables tracking of task statistics such as wait time, or time in progress, or time to completion, enabling capture of important task metrics in support of optimization and quality improvement.

**Boundaries and Relationships**

The task resource tracks the state of a task, enabling systems to ensure that tasks are completed. This information is kept separate from the operational details necessary to complete the task, as those details vary across and even within workflows. That detail is expected to be carried as the subject of the task.

Tasks may have named inputs and outputs. Inputs represent information that may or must be present in order for a task to complete. Outputs represent intermediate or final results produced by a task. For example, in a task supporting reading of radiology image, the inputs might include both the imaging study to be read, as well as relevant prior images. Outputs could represent radiology measurements as well as the Radiologist's diagnostic report.

Inputs and outputs are tracked by the task because workflow management activity may automate the transer of outputs from one task to inputs to a subsequent task.

To facilitate the integration of off the shelf workflow applications with FHIR, the task resource may reference a definition. This definition can represent a description of the workflow actitivity to be performed, using a standard workflow description language such as BPEL, BPMN, or XPDL, a workflow definition such as those defined in IHE profiles, or even simple written instructions explaining a process to be performed.

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**Task Titles**

Tasks are often have titles (eg "My Tasks", "Outstanding Tasks for Patient X") which can be presented in a list. The task title should go into the Task.code as a coded concept and/or text.

**Task state machine**

The following diagram reflects the "typical" state machine for Task. Note that not all states will be supported by all workflows and that some workflows may support additional transitions, including transitions from terminal states (e.g. back to "in-progress" from "failed" or "completed").

**The Cancelled state**

While the intention of a "cancelled" task is that all work authorized by the task should cease, this may not always be possible practice. It is possible that the originally requested action could still be completed and still attached to the Task but this would not change the status of the task. If the placer cancels a task, it signals they no longer care about the outcome of the task.

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**Scope and Usage**

Todo

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\appointment\appointment-examples-header.xml**

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**Scope and Usage**

Appointment resources are used to provide information about a planned meeting that may be in the future or past. The resource only describes a single meeting, a series of repeating visits would require multiple appointment resources be created for each instance. Examples include a scheduled surgery, a follow-up for a clinical visit, a scheduled conference call between clinicians to discuss a case, the reservation of a piece of diagnostic equipment for a particular use, etc. The visit scheduled by an appointment may be in person or remote (by phone, video conference, etc.) All that matters is that the time and usage of one or more individuals, locations and/or pieces of equipment is being fully or partially reserved for a designated period of time.

This definition takes the concepts of appointments in a clinical setting and also extends them to be relevant in the community healthcare space, and also ease exposure to other appointment / calendar standards widely used outside of healthcare.

**The basic workflow to create an appointment**

* **Discovery/Addressing**

Before an appointment can be made the address/endpoint details of the resource that we want to schedule an appointment with must be determined. This is often based on the healthcare Service Type, any formatting information which indicates how to make the request. This is typically handled via the Schedule resource.

* **Checking Availability on the Schedule(optional)**

This optional step permits the checking of any existing available times ([slot](file:///C:\temp\slot.html) resources associated with a selected [schedule](file:///C:\temp\schedule.html)) that can be booked against. Just because a time is indicated it is available doesn't guarantee that an appointment can be made. The booking system that is going to process the request may make other qualifying decisions to determine if the appointment can be made, such as permissions, assessments, availability of other resources etc.

This step is optional as the creation of the appointment is never a guaranteed action. But by performing this availability check, you can increase the chances of making a successful booking.

* **Making the Appointment Request**

When an appointment is required, a requester creates new Appointment resource with the Appointment.status="proposed".  
All included participants (optional or mandatory) should have the status="needs-action" to allow filtering and displaying appointments to user-participants for accepting or rejecting new and updated requests. Based on internal system business rules, certain statuses may be automatically updated, for example: "reject because the requested participant is on vacation" or "this type of user is not allowed to request those specific appointments".

* **Replying to the request**

The reply process is simply performed by the person/system handing the requests updating the participant statuses as needed. If there are multiple systems involved, then these will create AppointmentResponse entries with the desired statuses.

Once all participants have their participation status created/updated (and the main system marking the appointment participant records with the AppointmentResponse statuses) then the overall status of the Appointment is updated.

* **Checking the overall status (Requester)**

The requester (organizer) of the appointment checks for the overall status of the appointment (and appointment responses, where applicable) using FHIR pub-sub techniques.

Where the participant statuses indicate that a re-scheduling is required, then the process may start again, with other systems replying to a new set of times.

**There are 2 typical workflows that occur with appointments**

* **Outlook Style - Community**

These types of requests are typically handled by selecting a specific time from a list of available slots. Then making the request for that timeslot.

* **Hospital Scheduling - Clinical**

Clinical scheduling is often far more complex in its requirements and processing. Often this involves checking multiple availabilities across multiple systems and timing with other internal systems, not just those exposed by the Slot resources.

Consideration should be given to situations where scheduling needs to be handled in more of a queue-like process.

Note: This type of clinical appointment scheduling has not been specifically covered with this definition of the appointment (and the related resources), however if you would like to contribute to the modification of this resource to cover these use cases, please contact the HL7 Patient Administration work-group.

**Boundaries and Relationships**

**Appointment Request/Response Pattern**

When using a request response style of appointment this is done using Appointment and AppointmentResponse resources.  
The request is made in the form of an Appointment with a proposed or pending status, and the list of actors with a participation status of "needs-action".

Participants in the appointment respond their acceptance (or not) to the appointment by creating AppointmentResponse resources.  
Once all the participants have replied, then the appointment resource is able to be updated with an overall status which collates the results of all the participants and presents the approved details of the appointment.

The participant type property can be used to represent a specific role that a practitioner is required to perform for the appointment. This could be specified without an actor when the actual practitioner is not known, and will be filled in closer to the scheduled time.  
This property must be the same between the Appointment-participant and the AppointmentResponse so that the appropriate values can be allocated. If you need multiple actors of a specific type, then multiple participants with that type value are included on the appointment.

**Appointment Statuses and Encounters**

Appointments can be considered as Administrative only, and the Encounter is expected to have Clinical implications.

In general it is expected that appointments will result in the creation of an Encounter. The encounter is typically created when the service starts, not when the patient arrives. When the patient arrives, an appointment can be marked with a status of Arrived.

In an Emergency Room context, this appointment resource is probably not appropriate to be used. In these cases an encounter should be created.

The Appointment request pattern used is different to the order-response pattern used elsewhere in FHIR.  
This is due to the close relationship to the iCAL standard. Many non-clinical systems use generic non health appointment systems which implement this standard, and the desire to integrate with the consumer who has no access to health based software is highly desirable.  
The mappings to the iCAL standard have been provided to guide implementation of gateways between FHIR servers and iCAL systems.

**Appointment Locations and Participation**

The Location of the appointment is to be defined by using a participant that references a location or HealthcareService.  
This permits the location to also have its availability checked via a schedule and any conflicts more easily managed.

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**Typical Status Transition Examples:**

**Typical Flow of statuses for an appointment:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Activity Description** | **Slot** | **Appointment** | **Appointment Response** | **Encounter** |
| The Schedule is created/published  (Role: Scheduler) | freeBusyType = FREE |  |  |  |
| An appointment request is created after locating an available slot  (Role: Requester) |  | status = pending participant.status = needs-action |  |  |
| The appointment request is processed and the slot status updated (Role: Scheduler) | freeBusyType = BUSY-TENTATIVE |  |  |  |
| The appointment is accepted as described â€“ by all participants  (Role: Participant(s)) |  |  | participantStatus = accepted |  |
| The appointment is confirmed as accepted by all participants (Role: Scheduler) | freeBusyType = BUSY | status = booked participant.status = accepted |  |  |
| *Optional: Preparation for the appointment begins â€“ could be preparing a room for the appointment etc. (Role: Participants/Admin)* |  |  |  | status = planned (optional) location.status = planned |
| The patient arrives for the appointment, often sitting in a waiting room (Role: Admin) |  | status = arrived |  | status = arrived location.status = present |
| The practitioner and the patient meet and the provision of the service begins, appointment is finished with now  (Role: Scheduler/Participant(s)/Admin) |  | status = fulfilled |  | status = in-progress |
| The encounter concludes (Role: Scheduler/Participant(s)/Admin) |  |  |  | status = finished |

**Flow for the rejection/cancellation of an appointment**

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity Description** | **Slot** | **Appointment** | **Appointment Response** |
| The Schedule is created/published  (Role: Scheduler) | freeBusyType = FREE |  |  |
| Appointment Request is created (Role: Requester) |  | status = pending participant.status = needs-action |  |
| The appointment request is processed and the slot status updated (Role: Scheduler) | freeBusyType = BUSY-TENTATIVE |  |  |
| Participant Declines the Appointment (Role: Participant) |  |  | participantStatus = declined |
| The appointment is cancelled (Role: Scheduler) | freeBusyType = FREE | status = cancelled participant.status = declined |  |

**Flow for re-negotiation:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity Description** | **Slot** | **Appointment** | **Appointment Response** |
| The Schedule is created/published  (Role: Scheduler) | freeBusyType = FREE |  |  |
| An appointment is requested with Brian and Peter (Role: Requester) |  | status = proposed participant(Brian).status = needs-action participant(Peter).status = needs-action |  |
| The Schedule is updated to inform others of interest in the slot (Role: Scheduler) | freeBusyType = BUSY-TENTATIVE |  |  |
| Brian accepts the appointment (Role: Participant-Brian) |  |  | (Brian).participantStatus = accepted |
| Appointment is updated with Brian's status (Role: Scheduler) |  | status = pending participant(Brian).status = accepted |  |
| Peter suggests a new time (Role: Participant-Peter) |  |  | (Peter).participantStatus = tentative *(with new time)* |
| Appointment is updated with new time, and indicates that action is needed by both participants (Role: Scheduler) |  | *(new time details updated)* participant(Brian).status = needs-action participant(Peter).status = needs-action |  |
| Brian accepts the appointment (Role: Participant-Brian) |  |  | (Brian).participantStatus = accepted |
| Appointment updated (Role: Scheduler) |  | participant(Brian).status = accepted |  |
| (Role: Participant-Peter) |  |  | (Peter).participantStatus = accepted |
| Appointment updated (Role: Scheduler) | freeBusyType = BUSY | status = booked participant(Peter).status = accepted |  |

**Flow for a patient no-show:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Activity Description** | **Slot** | **Appointment** | **Appointment Response** | **Encounter** |
| *(from typical status flow)* | freeBusyType = BUSY | status = booked participant.status = accepted |  |  |
| Appointment is updated as a noshow (Role: Scheduler/Admin) |  | status = noshow |  | *(no encounter created)* |

**Notes:**

* Placer/Filler ([HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185))

The appointment information is effectively the same between the filler and placer, and given the nature of the fhir resource, there is only a single resource for both purposes. The Placer is the actor that performs the PUT or POST operation on the resource, and the filler is the actor that receives these resource messages and processes the information and makes a decision if the appointment can be used.

* Interaction with other Standards

The strong desire is that implementers of this resource should consider providing this resource in the iCalendar format as an alternative representation. Many 3rd party applications and component providers have parsers and user interface controls to display this information. This may lower the entry point to integrate outside the health-care specific applications, and into the consumer space. This would permit the easier creation of a mobile application that creates appointments in the devices native calendar.  
The iCalendar specification can be found at <http://www.ietf.org/rfc/rfc2445.txt>.

**STU Note:** Implementer feedback on is sought on the values for Appointment.priority and how interoperable they are. Using an extension to record a codeableconcept for named values may be tested at a future connectathon.

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

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**Scope and Usage**

Appointment resources are used to provide information about a planned meeting that may be in the future or past. They may be for a single meeting or for a series of repeating visits. Examples include a scheduled surgery, a follow-up for a clinical visit, a scheduled conference call between clinicians to discuss a case, the reservation of a piece of diagnostic equipment for a particular use, etc. The visit scheduled by an appointment may be in person or remote (by phone, video conference, etc.) All that matters is that the time and usage of one or more individuals, locations and/or pieces of equipment is being fully or partially reserved for a designated period of time.

This definition takes the concepts of appointments in a clinical setting and also extends them to be relevant in the community healthcare space, and also ease exposure to other appointment / calendar standards widely used outside of Healthcare.

**The basic workflow to create an appointment**

* **Making the Appointment Request**

When an appointment is required, a requester creates new Appointment resource with the Appointment.status="proposed".  
All included participants (optional or mandatory) should have the status="needs-action" to allow filtering and displaying appointments to user-participants for accepting or rejecting new and updated requests. Based on internal system business rules, certain statuses may be automatically updated, for example: "reject because the requested participant is on vacation" or "this type of user is not allowed to request those specific appointments".

* **Replying to the request**

The reply process is simply performed by the person/system handing the requests updating the participant statuses as needed. If there are multiple systems involved, then these will create AppointmentResponse entries with the desired statuses.

Once all participants have their participation status created/updated (and the main system marking the appointment participant records with the AppointmentResponse statuses) then the overall status of the Appointment is updated.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\appointmentresponse\appointmentresponse-notes.xml**

**Notes:**

* Time zones and recurring appointments

Recurring appointments need to have the time zone in which the values were entered in defined. Knowing that the start time was at 9:00:00Z+10 does not mean that the same time in 2 weeks is actually the same.

As if this was a time in Brisbane Australia, this time will be the same (in respect to its offset from UTC), however if this was for Melbourne Australia, during the daylight savings period of time Melbourne becomes +11. So without the additional information as to which time zone it was created in, scheduling a 9am appointment every Wednesday would not be possible.

* Placer/Filler ([HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185))

The appointment information is effectively the same between the filler and placer, and given the nature of the FHIR resource, there is only a single resource for both purposes. The Placer is the actor that performs the PUT or POST operation on the resource, and the filler is the actor that receives these resource messages and processes the information and makes a decision if the appointment can be used.

* Interaction with other standards

The strong desire is that implementers of this resource should consider providing this resource in the iCalendar format as an alternative representation. Many 3rd party applications and component providers have parsers and user interface controls to display this information. This may lower the entry point to integrate outside the health-care specific applications, and into the consumer space. This would permit the easier creation of a mobile application that creates appointments in the devices native calendar.  
The iCalendar specification can be found at <http://www.ietf.org/rfc/rfc2445.txt>.

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**Scope and Usage**

Tracking Financial information is vital in Patient Administration and Finance systems in most Healthcare Organizations. The resource ChargeItem describes the provision of healthcare provider products for a certain patient, therefore referring not only to the product, but containing in addition details of the provision, like date, time, amounts and participating organizations and persons. Main Usage of the ChargeItem is to enable the billing process and internal cost allocation. They are created as soon as the products are planned or provisioned, references to Encounters and/or Accounts can be maintained in a later process step.

The target of ChargeItem.definition may provide information on the Charge code such as pricing and inclusion/exclusion rules as well as factors that apply under certain conditions. In many cases however this information may been drawn from sources outside of FHIR depending on the distribution format of the code catalogue. The ChargeItem assumes that such information is either implicitly known by the communicating systems or explicitly shared through the ChargeItem.definition. Therefore explicit pricing information is not shared within the ChargeItem resource. Also, the systems posting the ChargeItems are not expected to apply the rules associated with the charge codes as they may not know the whole context of the patient/encounter to evaluate such rules. It lies within the responsibity of a billing engine, to collect the ChargeItems in the context of an Account or Encounter at a certain point in time (e.g. discharge of the patient) and evaluate the associated rules resulting in some of the ChargeItems to be set to the status "not billable" in case the rules exclude them from being billed or create financial transactions according to base price and factors. Additional references to Encounter/EpisodeOfCare, Patient/Group and Services provide futher context to help billing systems determine the appropriate account and establish the clinical/financial context to evaluate the rules associated with the charge codes.

**Boundaries and Relationships**

This resource is not an actual financial transaction (such as an item on an invoice or any concise monetary amout being transferred from one Account to another), but is the base administrative data that may be used by a billing engine to create the financial transactions based on rules, factors and base prices associated with the charge code.

Unlike the Financial Transaction the ChargeItem primarily describes the provision, whereas the Financial Transaction documents cash flow. Therefore, the Financial Transaction results from ChargeItems created via the subsequent billing- or cost allocation process.

The actual financial transaction resulting from the evaluation of these rules against the clinical and financial context may be represented in formats appropriate to the financial realm. These are considered out of scope for the FHIR Standard, as they are not specific to the healthcare domain. The FHIR Claim resource does contain line items, and this ChargeItem resource provides the source material for the billing engine to create the items on the claim (which may be different due to business rules).

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\encounter\encounter-examples-header.xml**

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**Scope and Usage**

A patient encounter is further characterized by the setting in which it takes place. Amongst them are ambulatory, emergency, home health, inpatient and virtual encounters. An Encounter encompasses the lifecycle from pre-admission, the actual encounter (for ambulatory encounters), and admission, stay and discharge (for inpatient encounters). During the encounter the patient may move from practitioner to practitioner and location to location.

Because of the broad scope of Encounter, not all elements will be relevant in all settings. For this reason, admission/discharge related information is kept in a separate Hospitalization component within Encounter. The *class* element is used to distinguish between these settings, which will guide further validation and application of business rules.

There is also substantial variance from organization to organization (and between jurisdictions and countries) on which business events translate to the start of a new Encounter, or what level of aggregation is used for Encounter. For example, each single visit of a practitioner during a hospitalization may lead to a new instance of Encounter, but depending on local practice and the systems involved, it may well be that this is aggregated to a single instance for a whole hospitalization. Even more aggregation may occur where jurisdictions introduce groups of Encounters for financial or other reasons. Encounters can be aggregated or grouped under other Encounters using the *partOf* element. See [below](file:///C:\temp\intros%20and%20notes.html#examples) for examples.

Encounter instances may exist before the actual encounter takes place to convey pre-admission information, including using Encounters elements to reflect the planned start date or planned encounter locations. In this case the *status* element is set to 'planned'.

The Hospitalization component is intended to store the extended information relating to a hospitalization event. This is always expected to be the same period as the encounter itself, where this is different then another encounter is entered which captures this information which is a partOf this encounter instance.

The Procedure and encounter have references to each other, and these should be to different procedures; one for the procedure that was performed during the encounter (stored in Prodecure.encounter), and another for cases where an encounter is a result of another procedure (stored in Encounter.indication) such as a followup encounter to resolve complications from an earlier procedure.

**Status Management**

During the life-cycle of an encounter it will pass through many statuses. Typically these are in order or the organizations workflow: planned, in-progress, finished/cancelled.  
This status information is often used for other things, and often an analysis of the status history is required. This could be done by scanning through all the versions of the encounter and then checking the period of each, and doing some form of post processing. To ease the burden of this (or where a system doesn't support resource histories) a status history component is included.

There is no direct indication purely by the status field as to if an encounter is considered "admitted".  
The context of the encounter and business practices/policies/workflows/types can influence this definition. (e.g., acute care facility, aged care center, outpatient clinic, emergency department, community based clinic).  
Statuses of "arrived", "triaged" or "in progress" could be considered the start of the admission, and also have the presence of the hospitalization sub-component entered.

The "on leave" status may or may not be a part of the admission, for example if the patient was permitted to go home for a weekend or some other form of external event.  
The location is also likely to be filled in with a location status of "present".  
For other examples such as an outpatient visit (Day Procedure - colonoscopy), the patient could also be considered to be admitted, hence the encounter doesn't have a fixed definition of admitted. At a minimum, we do believe that a patient IS admitted when the status is in-progress.

**Boundaries and Relationships**

The Encounter resource is not to be used to store appointment information, the Appointment resource is intended to be used for that. Note that in many systems outpatient encounters (which are in scope for Encounter) and Appointment are used concurrently. In FHIR, Appointment is used for establishing a date for the encounter, while Encounter is applicable to information about the actual Encounter, i.e. the patient showing up.  
As such an encounter in the "planned" status is not identical to the appointment that scheduled it, but it is the encounter prior to its actual occurrence, with the expectation that encounter will be updated as it progresses to completion. Patient arrival at a location does not necessarily mean the start of the encounter (e.g. a patient arrives an hour earlier than he is actually seen by a practitioner).

An appointment is normally used for the planning stage of an appointment, searching, locating an available time, then making the appointment. Once this process is completed and the appointment is about to start, then the appointment will be marked as fulfilled, and linked to the newly created encounter.  
This new encounter may start in an "arrived" status when they are admitted with a location of the facility, and then will move to the ward where another part-of encounter may begin.

Communication resources are used for a direct simultaneous interaction between a practitioner and a patient where there is no direct contact. Such as phone message, or transmission of some correspondence documentation.  
There is no duration recorded for a communication resource, but could contain sent and received times.

Standard Extension: **Associated Encounter**  
This extension should be used to reference an encounter where there is no property that already defines this association on the resource.

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**Notes**

* The *class* element describes the setting (in/outpatient etc.) in which the Encounter took place. Since this is important for interpreting the context of the encounter, choosing the appropriate business rules to enforce and for the management of the process, this element is required.
* In future versions of FHIR, some kind of charge posting vehicle (e.g. Account) will be added.

**Example usage**

As stated, Encounter allows a flexible nesting of Encounters using the partOf element. For example:

* A patient is admitted for two weeks - This could be modeled using a single Encounter instance, in which the start and length are given for the duration of the whole stay. The admitting doctor and the responsible doctor during the stay are specified using the Participant component.
* During the encounter, the patient moves from the admitting department to the Intensive Care unit and back - Three more detailed additional Encounters can be created, one for each location in which the patient stayed. Each of these Encounters has a single location (twice the admitting department and once the Intensive Care unit) and one or more participants at that location. These Encounters may use the partOf relationship to indicate these movements occurred during the longer overarching Encounter.
* During the last part of the stay, the patient is visited by the members of the multi-disciplinary team that treated him for final evaluation - If relevant, for each of these short visits, an Encounter may be created with a single participant. Since these took place during the last part of the stay, the partOf element can be used to associate these short visits with either the third patient movement or the bigger overall encounter.

Exactly how the Encounter is used depends on information available in the source system, the relevance of exchange of each level of Encounter and demands specific to the communicating partners. The expectation is that for each domain of exchange, profiles are used to limit the flexibility of Encounter to meet the demands of the use case.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\endpoint\endpoint-introduction.xml**

**Scope and Usage**

An endpoint describes the technical details of a location that can be connected to for the delivery/retrieval of information. Sufficient information is required to ensure that a connection can be made securely, and appropriate data transmitted as defined by the endpoint owner. This is not a description of details of the current system, as found in [CapabilityStatement](file:///C:\temp\capabilitystatement.html), but of another (potentially external) system.  
These may be locally hosted services, regional services, or national service.

These resources are typically used to identify where to locate endpoint details for:

* Questionnaires: Where to send information (currently an SDC extension with just the address)
* ValueSet: Where related Terminology Services can be found (where not local)
* Subscription: The destination to send the subscribed data (or to pull)
* Messaging: (currently defined in the Message Header, but only as the address)
* Referrals: Where to send referral requests  
  (linked to the services directory resources - Organization/Location/Practitioner/HealthcareService)
* Referrals - Templates: Where to locate referral templates (Questionnaires)  
  (linked to the services directory resources - Organization/Location/Practitioner/HealthcareService)
* CarePlans: Where a shared CarePlan can be found
* Scheduling: Where to lookup to discover schedules/availability information  
  (linked to the services directory resources - Organization/Location/Practitioner/HealthcareService)
* Scheduling: Where to lookup to send appointment requests  
  (linked to the services directory resources - Organization/Location/Practitioner/HealthcareService)
* Patient/Person: Location of Master Patient/Person Indexes
* Service Provider Directories: Location of related directories (parent/child/federated)

**Boundaries and Relationships**

The endpoint is distinct from a capability statement in that the CapabilityStatement statement describes the entire capability of a server (and in the metadata case, just this server)  
Where the endpoint resource describes the technical details for how to connect, and for what purposes (which could be a small sub-set of the server's capabilities, and may not be a FHIR endpoint).

**Background and Context**

**Expected Implementations**

* Any solution where there are distributed FHIR servers deployed and need discovery/configuration
* (Refer to the scope and usage section for common uses)

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\episodeofcare\episodeofcare-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\episodeofcare\episodeofcare-introduction.xml**

**Scope and Usage**

The EpisodeOfCare Resource contains information about an association of a Patient with a Healthcare Provider for a period of time under which related healthcare activities may occur.

In many cases, this represents a period of time where the Healthcare Provider has some level of responsibility for the care of the patient regarding a specific condition or problem, even if not currently participating in an encounter.

These resources are typically known in existing systems as:

* EpisodeOfCare: Case, Program, Problem, Episode
* Encounter: Visit, Contact

**Multiple Organizations and Transfer of Care**

Many organizations can be involved in an EpisodeOfCare, however each organization will have their own EpisodeOfCare which tracks their responsibility with the patient.

When an Organization completes their involvement with the patient and transfers care to another Organization. This is often in the form of a referral to another Organization (or Organizations).

When an incoming referral is received a new EpisodeOfCare may be created for this organization. The initial step(s) in the intake workflow for the referral often involve some form of assessment(s), eligibility, capacity, care levels, which could take some time.  
Once the intake process is completed and the patient is accepted, a CarePlan is often created.

**Boundaries and Relationships**

The primary difference between the EpisodeOfCare and the Encounter is that the Encounter records the details of an activity directly relating to the patient, while the EpisodeOfCare is the container that can link a series of Encounters together for problems/issues.  
The Example scenarios below give some good examples as to when you might want to be using an EpisodeOfCare.

This difference is a similar difference between the EpisodeOfCare and a CarePlan. The EpisodeOfCare is a tracking resource, rather than a planning resource.  
The EpisodeOfCare usually exists before the CarePlan. You don't need a CarePlan to use an EpisodeOfCare.

**Background and Context**

Systems collect a coherent group of activities (such as encounters) related to a patient's health condition or problem often referred to as a Care Episode. Information about an episode is often shared across systems, and in some cases organizational and disciplinary boundaries. An Episode Of Care contains details about the purpose of the care and can exist without any activities.  
The minimal information that would be required in an episode of care would be a patient, organization and a reason for the ongoing association. Other reasons for creating an EpisodeOfCare could be for tracking the details required for government reporting or billing.

**Expected Implementations**

* Chronic Disease Management Systems
* Community Care Systems
  + Tracking progress of a specific condition
  + Tracking government funding
* Problem based General Practice systems
* Disability Support Systems
* Aged Care Systems (Community and Residential)

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**Status Management**

**History and Period**

When an organization assumes responsibility for a patient, then the EpisodeOfCare is created and a start date entered to show when it has begun.  
As the organization's responsibility changes, so does the status of the EpisodeOfCare.  
This is described via an example below for an intake workflow.

**Leave Handling**

With long term care there is often a concept of the provision of care being suspended for various reasons. Many systems have extensive Leave Management/Tracking solutions which consider the complexities of this space, however this EpisodeOfCare resource is NOT intended to provide this level of tracking.  
Extension(s) may be used on the status/status history to track the on hold reason, which can facilitate the processing.

A more complete Leave Management solution may have to deal with:

* Leave Types
* Leave Entitlements
* Billing/Funding implications while on different types of leave

**Example Intake Workflow**

This example sequence demonstrates some status transitions and how other resources interact.  
The context could be in a Community/Aged Care/Disability/Mental Health setting.

* ReferralRequest received
* *intake clerk processes referral and decides that the first level eligibility has been met  
  (e.g. Have capacity in the facility for the patient, the patient is covered by VA)*
* EpisodeOfCare created with status of planned which is allocated as fulfilling the ReferralRequest
* *Further assessment of needs is scheduled to be taken, a care manager is probably allocated at this point*
* Assessment Practitioner sees the Patient and completes a series of relevant Questionnaires to rank the patient
* The assessments are reviewed and a formal CarePlan is created
* The EpisodeOfCare is updated to be marked as active, and the CareTeam is likely filled in
* *The provision of care is then managed through the care plan, with all activities will also being linked to the EpisodeOfCare*
* The patient is admitted to hospital for some procedures, and the EpisodeOfCare is marked as on hold  
  Some of the services on the CarePlan (or scheduled appointments) would be reviewed to determine if they can be performed without the patient (e.g., home maintenance), or if they should be suspended while the patient is on hold.
* The patient returns from the hospital and the EpisodeOfCare is marked as active again (and services reviewed again)
* *Patient wished to move to another area to be closer to family*
* Organization creates an outgoing ReferralRequest to a new Organization to continue the care
* The EpisodeOfCare is closed

In some jurisdictions an Organization may be funded by a government body for the days that a patient is under their care. These are known as "active days". This does not mean that they are actively receiving a service (an encounter), but that the organization is responsible for managing their care.  
This monthly reporting value can be easily extracted from the status history as described above.  
The actual provision of services may also be funded separately, and this would be via the Encounters.

**EpisodeOfCare Outcomes Review**

An Organization may perform analytics on their Episodes Of Care to have an understanding of how their business is performing.  
Observing that there was a 60/40 split of episodes being finished/cancelled is not very informative. The organization would prefer to know the reason why the episodes are completing so that they can plan their business effectively.  
Theyâ€™d be more interested in knowing whether it was due to services hitting their mandatory end date, client passing away, client transitioning to a higher level of services provided by them or to another provider etc.

Currently there are no attributes on this resource to provide this information. This would be very specific to each implementation and usage, so it would be recommended to use extensions to achieve this functionality.

**Example Scenarios**

A General Practitioner wants to review how well his patient is managing his diabetes over time from information within his clinic and also the regional community care organization's system(s).

The EpisodeOfCare enables the practitioner to easily separate the diabetes activities from the mental health problem's activities.

A Community Care organization wants to track all activities that occur with a patient relating to their disability to simplify the reporting to the government to receive funding to care for the patient

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**Scope and Usage**

The HealthcareService resource is used to describe a single healthcare service or category of services that are provided by an organization at a location.  
The location of the services could be virtual, as with TeleMedicine Services.

Common examples of HealthcareServices resources are:

* Allied Health
* Clinical Neuropsychologist
* Podiatry Service
* Smallville Hospital Emergency Services
* Respite care provided at a nursing home or hostel
* 24hr crisis telephone counseling service
* Information, advice and/or referral services; Disability, Telecommunications
* Rural TeleHealth Services
* Hospital in the home
* Yellow Cabs
* Pharmacy
* Active Rehab
* Social Support
* Drug and/or alcohol counseling
* Day Programs, Adult Training & Support Services
* Consulting psychologists and/or psychology services
* Group Hydrotherapy
* Little River Home Maintenance

*HealthcareService resources do not represent Computer related Services (not SOA)*

Example uses of HealthcareService resources are:

* National Services Directory - Consumer Focus
* National Services Directory - Practitioner Referrals Searching
* Organization's Client Portal - to locate services / book appointments
* Address book of services for Referrals  
  *including references to Questionnaires for assessments that are required as part of the referral*
* Health Network internal directory *Used for tracking available services offered internally, and also those offered by business partners.  
  This information may also include costing information.*

**Boundaries and Relationships**

The HealthcareService resource can be used with the Schedule resource to define actual availability of the service. This would be done by using the Schedule's Actor property.

When creating an Appointment, the HealthcareService is to be assigned to one of the participants.  
It is up to the scheduling system to determine if the service is available, and can be accepted.

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**Notes:**

* The HealthcareService could be mapped to components of the IHE Care Services Directory, and/or the OMG ServD standards

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**Scope and Usage**

A Location includes both incidental locations (a place which is used for healthcare without prior designation or authorization) and dedicated, formally appointed locations. Locations may be private, public, mobile or fixed and scale from small freezers to full hospital buildings or parking garages.

Examples of Locations are:

* Building, ward, corridor, room or bed
* Mobile Clinic
* Freezer, incubator
* Vehicle or lift
* Home, shed, or a garage
* Road, parking place, a park
* Ambulance (generic)
* Ambulance (specific)
* Patient's Home (generic)
* Jurisdiction

These locations are not intended to cover locations on a patient where something occurred (i.e. a patient's broken leg), but can hapily cover the location where the patient broke the leg (the playground)

**Boundaries and Relationships**

Locations and Organizations are very closely related resources and can often be mixed/matched/confused.  
The Location is intended to describe the more physical structures managed/operated by an organization, whereas the Organization is intended to represent the more conceptual hierarchies, such as a ward.

A Location is valid without an address in cases where it could be purely described by a geo-coded location in remote areas, or when recorded by a device. Locations with a mode = "kind" would also likely not have an address, as they are just a type of location, but could also have an address where they can be found at the address.

Another use of location could be for describing a Jurisdiction. This jurisdiction may be considered a classified boundary which could be a combination of a physical boundary, and some other discriminator(s):

* Nation - Country wide community or Federal Government (Ministry of Health)
* Province or State (community or Government)
* Business (throughout an enterprise)
* Business scope (CDC/FDA)
* Business segment (UK Pharmacy)

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**Notes**

* Multiple Organizations or Practitioners may provide services at a Location. These references are not kept in Location, but can be found in the models for [Organization](file:///C:\temp\organization.html) and [Practitioner](file:///C:\temp\practitioner.html) instead.
* Locations may range from whole buildings to cabinets; it is possible to relate smaller Locations to their containing bigger Location using the Location.partOf element.
* Location.position is expressed using the same syntax, datum and reference system as used in Google Earth's KML files, see [Google/OGS's KML](http://www.opengeospatial.org/standards/kml).

**Location Mode**

The Location.mode element can be used to indicate whether a Location resource represents a specific (potentially identifiable) Location ('instance'), or a class of Locations ('kind'). Especially Resources capturing orders, resource scheduling, plans and definitions may refer to Locations in 'kind' mode. For these domains, it is often not necessary to refer to a specific Location, but rather to a class of Locations. An example of this is found in planning, where we need to allocate an "isolation room" for a patient, or need to dispatch "an ambulance" at a certain time. In these cases it is not important exactly which isolation room or ambulance is allocated, and it is sufficient to just indicate a 'kind' of Location.

Note that 'kind' should not be used to represent Locations where an actual instance of a Location was involved, but identifying information is missing. E.g. when a patient arrived 'by ambulance', but it is not known by which ambulance, this should be represented using a Location in 'instance' mode with a missing identifier, not a Location of 'kind' ambulance.

Some of Location's data elements are only relevant when mode is 'instance' and should not be used when mode is 'kind':  
*(however this information could still be included if was relevant, such as when it is a generic item, but not globally generic, e.g. a Burgers MU ambulance)*

* Location.identifier
* Location.telecom
* Location.address
* Location.position
* Location.status
* Location.managingOrganization

**Example Location Hierarchy**

An example location hierarchy should help give some guidance as to one example of how a location hierarchy could look within a fictitious Hospital.  
*(The nesting here would be the "part-of" structure of the location)*

Hospital A Building C (instance)

East Wing (instance)

Level 1 (instance)

Reception (instance)

Nurses Station EM-ns1 (instance)

Medication Cupboard A (instance)

Room 1 (instance)

Room 1a (instance) - space in room separatable via a curtain

Bed 1a (instance) - always in this room

Room 1b (instance)

Trolley 43 (instance) - moves about

Room 1d (instance)

Trolley 19 (instance) - moves about

Room 2 (instance)

...

Theatre EM-TA (instance)

Coridor (generic)

Level 2 (instance)

Reception (instance)

...

Nurses Station EM-ns1 (instance)

Medication Cupboard A (instance)

Coridor (generic)

Mobile Services (kind)

Ambulance (kind)

Ambulance AMB1 (instance)

Ambulance AMB2 (instance)

*Note: Wards/departments are not part of this structure - these would form part of the Organizational Hierarchy.*

**Positional Searching**

Searching for locations often require that a facility is within a specified distance of a particular point. For example, to locate healthcare facilities within 2kms of a clients home, or the current geo-coded position of a practitioner travelling between patients (read from a mobile phone or device).

GET [base]/Location?near=-83.694810:42.256500&near-distance=11.20||km...

Note: The near search parameters are not able to be used with multiples thus the multiple seperator , should not be used with near or near-distance.

The distance between the location and the provided point is often used as one of the determining factors for selection of the location. So this value is included in the results.  
However the value cannot be inside the Location resource as it is different depending on the point of reference in the search. So the distance between is included in the search section of the bundle entry.

<entry>

<resource>

<Location>

<!-- location details -->

</Location>

</resource>

<search>

<extension url="http://hl7.org/fhir/StructureDefinition/location-distance">

<valueDistance >

<!-- The distance that this location resource is from the provided point in the query --<

</value value="10.5"/>

</unit value="km"/>

</valueDistance>

</extension>

</search>

</entry>

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**Scope and Usage**

This resource may be used in a shared registry of contact and other information for various organizations or it can be used merely as a support for other resources that need to reference organizations, perhaps as a [document](file:///C:\temp\documents.html), [message](file:///C:\temp\messaging.html) or as a [contained](file:///C:\temp\references.html#contained) resource. If using a registry approach, it's entirely possible for multiple registries to exist, each dealing with different types or levels of organization.

**Boundaries and Relationships**

The Organization resource is used for collections of people that have come together to achieve an objective. The [Group](file:///C:\temp\group.html) resource is used to identify a collection of people (or animals, devices, etc.) that are gathered for the purpose of analysis or acting upon, but are not expected to act themselves.

The Organization resource often exists as a hierarchy of organization resources, using the *part-of* property to provide the association of the child to its parent organization.  
This organizational hierarchy helps communicate the conceptual structure, whereas the Location resource provides the physical representation of the hierarchy.  
The linkage between Organization and Location is from each point in the location hierarchy to the appropriate level in the Organization hierarchy. These links don't all have to be to the top level Organization.  
When populating the organization and location hierarchies there is often not a clear distinction between these 2, however to assist in making the decision, Locations are always used for recording where a service occurs, and hence where encounters and observations are associated. The Organization property on these resources may not be the location where the service took place.

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**Notes:**

* There are two places for contact information: one on Organization itself and zero or more using the ContactEntity construct. The first one is to be used for the generic, public organization point of contact. The ContactEntity is to be used for reaching a person or party that has been designated by the organization to be contacted for a specific purpose or goal.

**Example Organization Hierarchy:**

An example organization hierarchy should help give some guidance as to one example of how a location hierarchy could look within a fictitious Medical Organization.  
*(The nesting here would be the "part-of" structure of the Organization resource)*

Burgers University Medical Center

Eastern Services (prov)

Emergency Dept

Oncology Dept

Neuclear Medicine Research Trials (edu)

Maternity Ward

Childrens Ward

Day Procedures Unit

Mobile Services (Ambulance)

Research Center (edu)

Neuclear Medicine (edu)

Burgers University (edu)

Neuclear Medicine Faculty (edu)

Undergraduate Medicine (edu)

...

*Note that physical structures of this hierarchy are not present - these are defined by a Location hierarchy.*

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**Scope and Usage**

This Resource covers data about patients and animals involved in a wide range of health-related activities, including:

* Curative activities
* Psychiatric care
* Social services
* Pregnancy care
* Nursing and assisted living
* Dietary services
* Tracking of personal health and exercise data

The data in the Resource covers the "who" information about the patient: its attributes are focused on the demographic information necessary to support the administrative, financial and logistic procedures. A Patient record is generally created and maintained by each organization providing care for a patient. A patient or animal receiving care at multiple organizations may therefore have its information present in multiple Patient Resources.

Not all concepts are included within the base resource (such as race, ethnicity, organ donor status, nationalilty, etc.), but may be found in [profiles](file:///C:\temp\patient-profiles.html) defined for specific jurisdictions (e.g., US Meaningful Use Program) or [standard extensions](file:///C:\temp\patient-extensions.html).  
Such fields vary widely between jurisdictions and often have different names and valuesets for the similar concepts, but they are not similar enough to be able to map and exchange

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Notes:

* multipleBirth can be either expressed as a Boolean (just indicating whether the patient is part of a multiple birth) or as an integer, indicating the actual birth order.
* Patient records may only be in one of two statuses: in use (active=true) and not in use (active=false). A normal record is active, i.e. it is in use. Active is set to 'false' when a record is created as a duplicate or in error. A record does not need to be linked to be inactivated.
* The *link* element is used to assert that two or more Patient resources are both about the same actual patient. See below for further discussion
* There should be only one preferred language (Language.preference = true) per mode of expression.
* The Contact for a Patient has an element *organization*, this is for use with guardians or business related contacts where just the organization is relevant.

**Patient id's and Patient resource id's**

A Patient record's Resource Id can never change. For this reason the identifiers with which humans are concerned (often called MRN - Medical Record Number, or UR - Unit Record) should not be used for the resource's id, since MRN's may change, i.e. as a result of having duplicate records of the same patient. Instead they should be represented in the *Patient.identifier* list where they can be managed. This is also useful for the case of institutions that have acquired multiple numbers because of mergers of patient record systems over time.

**Linking Patients**

The *link* element is used to assert that patient resources refer to the same patient. This element is used to support the following scenarios where multiple patient records exist:

**Duplicate Patient records**

Managing Patient registration is a well known difficult problem. Around 2% of registrations are in error, mostly duplicate records. Sometimes the duplicate record is caught fairly quickly and retired before much data is accumulated. In other cases, substantial amounts of data may accumulate. By using a link of type 'replaced-by', the record containing such a link is marked as a duplicate and the link points forward to a record that should be used instead. Note that the record pointed to may in its turn have been identified as created in error and forward to yet another Patient resource. Records that replace another record *may* use a link type of 'replaces' pointing to the old record.

**Patient record in a Patient index**

A Patient record may be present in a system that acts as a Patient Index: it maintains a (summary of) patient data and a list of one or more servers that it are known to hold a more comprehensive and/or authorative record of the same patient. The link type 'refer' is used denote such a link. Note that linked records may contain contradictory information. The record referred to does not point back to the referring record.

**Distributed Patient record**

In a distributed architecture, multiple systems keep separate patient records concerning the same patient. These records are not considered duplicates, but contain a distributed, potentially overlapping view of the patient's data. Each such record may have its own focus or maintaining organization and there need not be a sense of one record being more complete or more authorative than another. In such cases, links of type 'see also' can be used to point to other patient records. It is not a requirement that such links are bilateral.

**Patient vs. Person vs. Patient.Link**

The Person resource on the surface appears to be very similar to the Patient resource, and the usage for it is very similar to using the Patient.Link capability.  
The intention of the Person resource is to be able to link instances of resources together that are believed to be the same individual. This includes across resource types, such as RelatedPerson, Practitioner, Patient and even other Person resources.  
The Patient Link however is only intended to be used for Patient resources.

The primary use case for the Person resource is to be able to support person registries that do not necessarily have a healthcare context, and are able to identify and quantify confidence levels that this is the same person.  
This could include consumer portals where the maintainer of the person information is the actual person themselves.  
A system could use the Person entry to cross check changes to information applied to one part of a record to values in another system; e.g., when moving, a consumer updates his contact numbers and address in his person record, and then a Patient Administration system is able to see that this data is changed and prompt the organization to follow up with the patient that was linked to the person record if they want their details updated, or if they no longer need services and they should be cancelled, as they've moved from the area.

**Patient.contact vs. RelatedPerson**

The contact element on the Patient Resource should be used for storing people to contact information. Where a system has a separate record for other people for purposes other than just the contact details, the RelatedPerson resource should be used.  
This includes cases where these related people are actually contributing to the record, and need to be referenced individually (e.g. CarePlan.Participant, Encounter, DocumentReference, Appointment) where the Patient.Contact component cannot be used.

It is not expected that these records will be used for recording the primary care provider; this information should be stored in the Patient.generalPractitioner field.

**Patient Gender**

Tracking a patient's gender presents a number of challenges due to biological variations, differing cultural expectations and legal restrictions, and the availability of various kinds of gender re-assignment. The basic gender included in Patient.gender has a limited use, that of the *administrative*gender: the gender that the patient is considered to have for administration and record keeping purposes. In addition, to this gender, other kinds of gender may be represented:

* Birth Sex - the sex assigned at birth / on the birth registration. Some countries allow variations such as not yet determined, unknown, or undifferentiated, while others do not. The US realm defines a US Specific extension for this for Meaningful Use
* Clinical Gender - an observation about the patient, typically using the [LOINC](file:///C:\temp\loinc.html) code [76691-5](http://loinc.org/76691-5)). LOINC also provides a [set of possible codes](http://r.details.loinc.org/AnswerList/LL3322-6.html), or SNOMED CT has the descendents of [285116001](http://www.snomedbrowser.com/Codes/Details/285116001): Gender identity finding

Other related Observations may describe the Karyotypic/Genetic, Gonadal, Ductal, Phenotypic status of a patient.

For veterinary use the animal component also includes the genderStatus which indicates sterility information.

**Mother and newborn relationships**

There are several ways to represent the relationship between a mother and a child. This is due to the when it is recorded and the purpose for which it is recorded:

* To express the family relationship and legal responsibility thereof for administrative purposes: use the Patient/RelatedPerson structure.  
  This structure is consistent over time.
* To relate the encounter of a mother and her baby for a maternity encounter, for administrative and billing purposes: use the [encounter.partof](file:///C:\temp\encounter-definitions.html#Encounter.partOf) property
* To collect information about the patient's relatives that might be relevant to the patient's medical condition: use the [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html) resource

During a maternity encounter, the Patient and Encounter resources for the mother will be present. After the child is born, new Patient, Encounter and RelatedPerson (for the mother) records will be created. The Child's encounter should reference the Mother's encounter using the partOf property.  
The Patient/RelatedPerson structure should also be created for ongoing usage, as shown in this example:

<Patient>

<id value="child"/>

<!-- The details of the child -->

</Patient>

<RelatedPerson>

<id value="rp-mom"/>

<patient>

<reference value="Patient/child"/>

</patient>

</RelatedPerson>

<Patient>

<id value="pat-mom"/>

<!-- The details of the mom -->

<link>

<other value="rp-mom"/>

<type value="see-also"/>

</link>

</Patient>

<Encounter>

<id value="mom-enc"/>

<status value="in-progress"/>

<class value="inpatient"/>

<patient>

<reference value="Patient/mom"/>

</patient>

</Encounter>

<Encounter>

<id value="child-enc"/>

<status value="in-progress"/>

<class value="inpatient"/>

<patient>

<reference value="Patient/child"/>

</patient>

<partOf>

<reference value="Encounter/mom-enc"/>

</partOf>

</Encounter>

**Merging records**

This specification does not specify merge functionality: if multiple patient records are found to be duplicates, they can be linked together, as described above. These links merely express the relationship between records, and in the case of a replacement link, indicate a "master" record. This specification does not mandate that FHIR servers migrate information between such records on finding such a link. Note:

* Health information administrators may call the process "merging", but it is often implemented as "linking" at the record level
* Servers are allowed to implement merging/record migration even though it is not mandated.

**STU Note:** We are seeking input from the implementer community on what effect linking/merging/unlinking should have on other functionality such as the GET operation (where the result is the old version of the Patient), searching, reverse includes, etc.; e.g., should observation resources from all linked/merged patients be returned when querying for one of them?  
How should an unlink behavior be done? (Assuming that no data was "re-allocated" as part of merge) These suggested updated behaviors could be the subject of a future connectathon.

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

**Patient Matching using an MPI**

A Master Patient Index ([MPI](http://en.wikipedia.org/wiki/Enterprise_master_patient_index)) is a service used to manage patient identification in a context where multiple patient databases exist. Healthcare applications and middleware use the MPI to match patients between the databases, and as new patient details are encountered. MPIs are highly specialized applications, often tailored extensively to the institution's particular mix of patients. MPIs can also be run on a regional and national basis.

To ask an MPI to match a patient, clients call the patient [$match](file:///C:\temp\patient-operations.html#match) operation, which processes a parameters resource containing a complete or fragment of a patient resource, along with some other control parameters.  
This provided patient resource does not need to pass full validation (mandatory fields, or invariants) as the resource will not be stored, it does however need to be a parsable instance.  
The MPI can then use the properties of the resource as MPI inputs, and processed using an internal MPI algorithm of some kind to determine the most appropriate matches in the patient set. It does not have to use all the properties provided, and may ignore others provided quietly.  
A specific profile (with the required fields/invariants) can be used to define what parameters the MPI algorithm requires.

POST [base]/Patient/$match

[some headers including content-type xml or json]

[parameters body with patient resource inside]

The response from an "mpi" $match operation is a set of patient records, ordered from most likely to least likely. If there are not patient matches, the MPI SHALL return an empty search set with no error, but may include an [operation outcome](file:///C:\temp\operationoutcome.html) with further advice. All patient records SHALL have a score from 0 to 1, where 1 is the most certain match, along with an [extension](file:///C:\temp\extensibility.html) ["match-grade"](file:///C:\temp\extension-match-grade.html) that indicates the MPI's position on the match quality:

<entry>

<resource>

<Patient>

<!-- patient details -->

</Patient>

</resource>

<search>

<extension url="http://hl7.org/fhir/StructureDefinition/match-grade">

<valueCode value="probable"/>

</extension>

<score value="0.80"/>

</search>

</entry>

The patient-mpi-match extension has one of the [following codes](file:///C:\temp\valueset-match-grade.html):

[%codelist-nh http://hl7.org/fhir/match-grade%]

The purpose of using an MPI search versus a regular search is that the MPI search is really intended to target and find a specific single patient for recording information about reducing errors through incorrectly selecting the wrong patient. Often MPIs won't return data if there is insuffience search parameter data, such as a partial surname.  
This compares to a regular search which can be used for finding lists of patients, such as to locate a group of patients that share a property in common, such as live in a specific location, or fit within an age range for performing population analysis.

**STU Note:** We are seeking input from the implementer community on the applicability of this new $match operation, and if it should become a standard operation that could be applicable to other resource types (e.g. Practitioner, RelatedPerson, Condition, Medication ...) These suggested updated behaviors could be the subject of a future connectathon.

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

A [formal definition](file:///C:\temp\patient-mpi-search.html) for the MPI $match operation is published.

**STU Note:** This is the first draft of this approach, as a result of connectathon testing.

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

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**Scope and Usage**

An individual has identity outside of a healthcare setting. The Person resource is used to capture this information and to relate the person as an individual to other resources that do have a health-related context.

For example, while a patient resource may be created and maintained by each organization providing care for that person as a patient, a person resource provides a mechanism for linking patient resources across different organizations and their unique patient identity domains.

This resource is not referenced by any other resources.

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**De-normalized Data**

Most of the properties of the Person resource are replicated within the other resources that they are shared with. This is intentional and highlights that the "disconnectedness" of the resources.

Not many systems actually implement a shared Person record, and as such the values DO become out of sync with each other. The inclusion of this resource does permit a capability for systems to identify other instances of this actual person's data via a centralized registry that can assist in keeping things up to date.

**Person and Linking**

The *link* element is used to relate resources under a common person record. This element supports two primary scenarios where other resources refer to the same person resource.

The *link* element cannot be used to link to RelatedPerson entries. So we can utilize a Person resource to relate these elements together identifying them as the same individual.

**Cross-Domain Patient Directory**

In a data sharing network, finding the location of patient records across different systems is a necessary pre-requisite for accessing external patient data. Using the *link* element, systems associate patient resources from different organizations. The assuranceLevel associated with the *link* provides a way for a system to qualify its confidence in the asserted *link*. For example, a relationship from the person to a patient using a probabilistic matching algorithm may be represented using a *link* with an assurance level of level1, while a relationship established using a government-issued photo ID may be created with an assurance level of level3.

**Cross-Domain Provider Directory**

Similarly, providers working in multiple healthcare service settings may be linked across different organizations using the *link* element. The various practitioner resources can be related using a common person resource with a *link* for each of the practitioner resources located in other organizations.

**Client Portal**

Client Portals provide consumer access to a window of their data locked up in healthcare systems. In many cases these systems are externally integrated and do not have access to the legacy CIS/PAS systems.

In contrast to most systems where a user has access to multiple patients depending on their roles and permissions, a client portal provides a consumer with direct access to their data (with permissions applied). This can also include not just their data (via the Person.link Patient entries), but also to information that they have entered, or were involved with (via the Person.link RelatedPerson entries), such as observations that they entered.  
With appropriate permissions/consent applied, the user could have access to other Patient records linked via a RelatedPerson.

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**Scope and Usage**

Practitioner covers all individuals who are engaged in the healthcare process and healthcare-related services as part of their formal responsibilities and this Resource is used for attribution of activities and responsibilities to these individuals. Practitioners include (but are not limited to):

* physicians,Â dentists,Â pharmacists
* physician assistants,Â nurses, scribes
* midwives,Â dietitians,Â therapists,Â optometrists, paramedics
* medical technicians,Â laboratory scientists, prosthetic technicians, radiographers
* social workers, professional home carers, official volunteers
* receptionists handling patient registration
* IT personnel merging or unmerging patient records
* Service animal (e.g., ward assigned dog capable of detecting cancer in patients)

**Boundaries and Relationships**

The Resource SHALL NOT be used for persons involved without a formal responsibility like individuals taking care for friends, relatives or neighbors. These can be registered as a Patient's Contact. If performing some action or being referenced by another resource, use the [RelatedPerson](file:///C:\temp\relatedperson.html)resource.

The primary distinction between a Practitioner and a RelatedPerson is based on whether:

* The person/animal operates on behalf of the care delivery organization over multiple patients (Practitioner) or,
* Where the person/animal is not associated with the organization, and instead is allocated tasks specifically for the RelatedPerson's Patient (RelatedPerson).

A standard extension [animalSpecies](file:///C:\temp\extension-practitioner-animalspecies.html) can be used to indicate the species of a service animal.

The [PractitionerRole](file:///C:\temp\practitionerrole.html) resource provides the details of roles that the practitioner is approved to perform for which organizations (an at which locations, and optionally what services too).

Practitioners are also often grouped into [CareTeams](file:///C:\temp\careteam.html) independently of roles, where the CareTeam defines what specific role that they are fulfilling within the team, and may or may not have actual practitioner role resources created for the practitioner (and in the care team context, the organization the practitioner is representing)

**Background and Context**

Practitioner performs different roles within the same or even different organizations. Depending on jurisdiction and custom, it may be necessary to maintain a specific Practitioner Resource for each such role or have a single Practitioner with multiple roles. The role can be limited to a specific period, after which authorization for this role ends. Note that the represented organization need not necessarily be the (direct) employer of a Practitioner.

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**Notes:**

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

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**Scope and Usage**

PractitionerRole covers the recording of the location and types of services that Practitioners are able to provide for an organization.

The role, specialty, Location telecom and HealthcareService properties can be repeated if required in other instances of the PractitionerRole. Some systems record a collection of service values for a single location, others record the single service and the list of locations it is available. Both are acceptable options for prepresenting this data.

**Boundaries and Relationships**

Qualifications (from the Practitioner resource) do not imply a Roles, but might be considered when an Organization allocates practitioners to roles within their organization, and could provide useful information (such as expiry information) which could need to be tracked in some situations to ensure they continue to be eligible for a specific role.

The [CareTeam](file:///C:\temp\careteam.html) resource is also often used to provide details of a role that a practitioner is allocated to perform, but is usually scoped to a much finer granularity of care, and often within the specific context of a [Patient](file:///C:\temp\patient.html), or functional role (eg. Crisis planning team). In contrast the PractitionerRole is used in a more general sense to cover all the places that the practitioner is allocated to work (and specific details relevant to that role - such as a specific contact number, or electronic services endpoint).

**Background and Context**

Practitioner performs different roles within the same or even different organizations. Depending on jurisdiction and custom, it may be necessary to maintain a specific Practitioner Resource for each such role or have a single Practitioner with multiple roles. The role can be limited to a specific period, after which authorization for this role ends. Note that the represented organization need not necessarily be the (direct) employer of a Practitioner.

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**Notes:**

* There is no address on the PractitionerRole as the location that is defined here contains the address.  
  This prevents having to duplicate the address values across multiple resources.

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**Scope and Usage**

RelatedPersons typically have a personal or non-healthcare-specific professional relationship to the patient. A RelatedPerson resource is primarily used for attribution of information, since RelatedPersons are often a source of information about the patient. For keeping information about people for contact purposes for a patient, use a Patient's Contact element. Some individuals may serve as both a Patient's Contact and a Related Person.

Example RelatedPersons are:

* A patient's wife or husband
* A patient's relatives or friends
* A neighbor bringing a patient to the hospital
* The owner or trainer of a horse
* A patient's attorney or guardian
* A Guide Dog

**Boundaries and Relationships**

The primary distinction between a Practitioner and a RelatedPerson is based on whether:

* The person/animal operates on behalf of the care delivery organization over multiple patients (Practitioner) or,
* Where the person/animal is not associated with the organization, and instead is allocated tasks specifically for the RelatedPerson's Patient (RelatedPerson).

A standard extension [animalSpecies](file:///C:\temp\extension-practitioner-animalspecies.html) can be used to indicate the species of a service animal.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\schedule\schedule-examples-header.xml**

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**Scope and Usage**

Schedule resources provide a container for time-slots that can be booked using an appointment. It provides the window of time (period) that slots are defined for and what type of appointments can be booked.  
The schedule does not provide any information about actual appointments. This separation also greatly assists where access to the appointments would not be permitted for security or privacy reasons, while still being able to determine if an appointment might be available.

Note: A schedule is not used for the delivery of medication, that is the [Timing](file:///C:\temp\datatypes.html#Timing) data type.

**Context**

A schedule controls the dates and times available for the performance of a service and/or the use of a resource. One schedule applies to one service or resource, since each service or resource can be reserved independently of the others.  
If two or more services, people, locations, or things cannot be reserved independently of one another, they are considered to be one activity or resource.

A schedule consists of slots of time during which the controlled service or resource is potentially available for provision or use. Slots are categorized as open, booked, or blocked. An open slot on a schedule indicates that the service or resource is available for provision or use during that period of time. A booked slot indicates that the service or resource is not available during the time period, because an appointment has been scheduled. A blocked slot indicates that a service or resource is unavailable for reasons other than a scheduled appointment.

The real-world, non-automated analog of the schedule described above is a standard appointment book. These books are generally organized with rows of time slots, during which a service or resource is available.

A slot is one unit on a schedule. A slot represents the smallest unit of time or quantity that a service or resource may be booked. Depending on the nature of the service or resource, there may be more than one defined slot at a given instant of time. For example, if a service is an open group therapy session with twelve available seats, then there are twelve slots for the given block of time.

**Actor - What the schedule applies to**

The schedule belongs to a single instance of a service or resource. This is normally a HealthcareService, Practitioner, Location or Device. In the case where a single resource can provide different services, potentially at different location, then the schedulable resource is considered the composite of the actors.   
For example, if a practitioner can provide services at multiple locations, they might have one schedule per location, where each schedule included both the practitioner and location actors. When booking an appointment with multiple schedulable resources, multiple schedules may need to be checked depending on the configuration of the system.

If an appointment has two practitioners, a specific medical device and a room then there could be a schedule for each of these resources that may need to be consulted to ensure that no collisions occur.  
If the schedule needed to be consulted, then there would be one created covering the planning horizon for the time of the appointment.

**Checking availability - Searching**

When checking availability for an appointment, the creator of the appointment should determine which schedules are applicable, then check for available slots within each schedule.

Determining which schedules should be consulted often will involve searching via the properties of the referenced actors, such as the ServiceCategory on the HealthcareService, or the Address on a Location.

The type parameter can be used to filter the type of services that can be booked within the associated slots.

If all slots are busy, the caller may attempt to book an appointment into a already booked slot, but the server business rules will dicate whether overbooking is allowed, or whether the appointment may be given a higher precedence and allocated the overbooked slot.

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**Notes:**

**Interaction with other Standards**

The strong desire is that implementers of this resource should consider providing this resource in the iCalendar format as an alternative representation. Many 3rd party applications and component providers have parsers and user interface controls to display this information. This may lower the entry point to integrate outside the health-care specific applications, and into the consumer space. This would permit the easier creation of a mobile application that creates appointments in the devices native calendar.  
The iCalendar specification can be found at <http://www.ietf.org/rfc/rfc2445.txt>.

**Slots - not a contained resource**

Due to the dynamic nature of slots they are not included as a part of this resource.

It is anticipated that this resource is likely to be updated intermittently when the scope of slots is changed, i.e. to change the period of slots in the planning horizon. This could be performed each night to move the start and end date forward to keep the planning horizon as exactly 4 weeks.

The slot resource however is anticipated to be updated very regularly as the appointments that reference them are created/updated/cancelled.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\slot\slot-introduction.xml**

**Scope and Usage**

Slot resources are used to provide time-slots that can be booked using an appointment. They do not provide any information about appointments that are available, just the time, and optionally what the time can be used for. These are effectively spaces of free/busy time.  
Slots can also be marked as busy without having appointments associated.

A slot can have more than one appointment allocated to it. A scheduling system may permit multiple allocations up to a specific number of places. An example of this type of usage could be where the slot is being used for a group service that permits 5 participants at the same time.

A slot can be marked as over-booked indicating that there are too many appointments allocated to it.

In some situations a service may have a specific set of slots reserved for specific uses, such as "walk-ins" or a specific organization has a "standing booking" for Thursday mornings. These should be represented using the appointmentType field with a specified and agreed value.  
Security Permissions or specific business rules on the system could enforce that only eligible appointments are allocated to them.

If a service had a weekly schedule created that permitted eight 1 hour appointments each day of a working week (Monday - Friday), this would be constructed by a single Schedule resource with the dates for the start and end of the week set, and then 40 (5x8) Slot resources associated with it.  
As appointments fill up the schedule, these slots would individually be marked as busy as the appointments are filled into the slots.  
The slots in a schedule do not need to be the same size, and can be different for different days of the week.

Slot instances do not have any recurrence information included. If recurring information is desired, this will be managed outside these resources, or included as extensions.

Note that booking an appointment does not necessarily require that slot resources be identified. When attempting to book an appointment, if the requestor knows ahead of time which schedulable resources are required, then identifying individual slots from the resources' schedules prior to creating the appointment is appropriate. However, in some medical scheduling scenarios, determining which resources are required for an appointment is very complex, and options other than using schedule+slot may be a better solution.

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**Notes:**

* Interaction with other Standards

The strong desire is that implementers of this resource should consider providing this resource in the iCalendar format as an alternative representation. Many 3rd party applications and component providers have parsers and user interface controls to display this information. This may lower the entry point to integrate outside the health-care specific applications, and into the consumer space. This would permit the easier creation of a mobile application that creates appointments in the devices native calendar.  
The iCalendar specification can be found at <http://www.ietf.org/rfc/rfc2445.txt>.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\allergyintolerance\allergyintolerance-introduction.xml**

**Scope and Usage**

A record of a clinical assessment of an allergy or intolerance; a propensity, or a potential risk to an individual, to have an adverse reaction on future exposure to the specified substance, or class of substance.

Where a propensity is identified, to record information or evidence about a reaction event that is characterized by any harmful or undesirable physiological response that is specific to the individual and triggered by exposure of an individual to the identified substance or class of substance.

Substances include, but are not limited to: a therapeutic substance administered correctly at an appropriate dosage for the individual; food; material derived from plants or animals; or venom from insect stings.

**Note for Reviewers**

Presently open issues for this resource:

* This resource represents a condition of susceptibility to a substance, with a list of supporting events and/or symptoms, and has no direct relationship to an event reporting framework; this will be re-assessed when adverse event reporting resource(s) and/or profiles are added to FHIR
* Other HL7 models and the openEHR archetype have "exposure date" but this is not found in any surveyed systems, so this is left as an extension (more appropriate for adverse event reporting)

**Boundaries and Relationships**

This resource is used to provide a single place within the health record to document a range of clinical statements about adverse reactions to substances/products, including:

* record a clinical assessment of the individual's propensity to a potential future reaction upon re-exposure
* record cumulative information about the reaction to each exposure, including 'no reaction' if appropriate

Use to record information about the positive presence of the risk of an adverse reaction:

* to support direct clinical care of an individual
* as part of a managed adverse reaction or allergy/intolerance list
* to support exchange of information about the propensity and events related to adverse reactions
* to inform adverse reaction reporting
* to assist computerized knowledge-based activities such as clinical decision support and alerts

Use to record information about adverse reactions to a broad range of substances, including: biological & blood products; incipients and excipients in medicinal preparations; foods; metal salts; and organic chemical compounds.

Adverse reactions may be:

* an allergy (typically type I hypersensitivity, plus other "allergy-like" reactions, including pseudoallergy)
* an intolerance (typically non-immune adverse reactions that are not determined or perceived to be allergic or "allergy-like", and are to some degree idiosyncratic and/or individually specific [i.e. are not a reaction that is expected to occur with most or all patients given similar circumstances])

In clinical practice distinguishing between allergy and intolerance is difficult and may not be practical. Often the term "allergy" is used rather generically and may overlap with "intolerance", and the boundaries between these concepts may not be well-defined or understood. As noted above, the term "intolerance" should generally be applied to a propensity for adverse reactions which is either determined (to the extent that is possible) or perceived to not be allergic or "allergy-like". If it is not possible to determine whether a particular propensity condition is an allergy or an intolerance, then the type element should be omitted from the resource. Identification of the type of reaction is not a proxy for seriousness or risk of harm to the patient, which is better expressed in the documentation of the clinical manifestation and the assessment of criticality.

The sensitivity in the case of either an allergy or intolerance is unique to the individual, and is distinguished from those reactions that are a property of the circumstance, such as toxicity of a food or drug, overdose, drug-drug, drug-food, or drug-disease interaction (which are reactions that would be expected to occur for any individual given the same circumstances).

The risk of an adverse reaction event or manifestation should not be recorded without identifying a proposed causative substance (including pharmaceutical products) or class of substance. If there is uncertainty that a specific substance is the cause, this uncertainty can be recorded using the 'verificationStatus' data element. If there are multiple possible substances that may have caused a reaction/manifestation, each substance should be recorded using a separate instance of this resource with the 'verificationStatus' set to an initial state of 'unconfirmed' so that adverse reaction checking can be supported in clinical systems. If a substance, agent or class is later proven not to be the cause for a given reaction then the 'verificationStatus' can be modified to 'refuted'.

This resource has been designed to allow recording of information about a specific substance (e.g., amoxicillin, oysters, or bee sting venom) or pharmaceutical product or, alternatively, a class of substance (e.g., penicillins). If a class of substance is recorded, then identification of the exact substance can be recorded on a per exposure basis.

The scope of this FHIR resource has deliberately focused on identifying a pragmatic data set that is used in most clinical systems or will be suitable for most common clinical scenarios; [extensions can be used](file:///C:\temp\extensibility.html) to add additional detail if required. Examples of clinical situations where the extension may be required include: a detailed allergist/immunologist assessment, for reporting to regulatory bodies or use in a clinical trial.

The act of recording any adverse reaction in a health record involves the clinical assessment that a potential hazard exists for an individual if they are exposed to the same substance/product/class in the future - that is, a relative contraindication - and, in the absence of additional information indicating a higher level of potential risk, the default 'criticality' value should be set to 'Low Risk'. If a clinician considers that it is not safe for the individual to be deliberately re-exposed to the substance/product again, for example, following a manifestation of a life-threatening anaphylaxis, then the 'criticality' data element should be amended to 'High Risk'.

A formal adverse event report to regulatory bodies is a document that will contain a broad range of information in addition to the specific details about the adverse reaction. The report could utilize parts of this resource plus include additional data as required per jurisdiction.

An adverse reaction or allergy/intolerance list is a record of all identified propensities for an adverse reaction for the individual upon future exposure to the substance/product or class, plus provides potential access to the evidence provided by details about each reaction event, such as manifestation.

Valuable first-level information that could be presented to the clinician when they need to assess propensity for future reactions are:

* statements about previous clinical manifestations following exposure
* source of the information/reporter
* the 'criticality' flag

Second-level information can be drawn from each exposure event and links to additional detailed information such as history, examination and diagnoses stored elsewhere in the record, if it is available.

**AllergyIntolerance and RiskAssessment**

AllergyIntolerance describes a specific type of risk - propensity to reaction to a substance/product while [RiskAssessment](file:///C:\temp\riskassessment.html) describes general risks to a subject, not generally based on a reaction.

**AllergyIntolerance and Immunization.reaction**

[Immunization.reaction](file:///C:\temp\immunization-definitions.html#Immunization.reaction) may be an indication of an allergy or intolerance. If this is deemed to be the case, a separate [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) record should be created to indicate it, as most systems will not query against past immunization.reactions.

**Misuse**

* The allergy/intolerance list exists as a patient safety tool to inform decision support around ordering of medications and nutrition and to guide clinical treatment. Other reactions triggered by physical stimuli -- light, heat, cold, pressure, vibration, which may mimic allergic or intolerance reactions, should be recorded as [Condition](file:///C:\temp\condition.html) on the problem list, not using AllergyIntolerance.
* Not to be used to record adverse events, including failures of clinical process, interventions or products. For example, abnormal use or mistakes/errors made in maladministration of an agent or substance, incorrect dosage, mislabeling, harm or injury caused by an intervention or procedure, overdose/poisoning, etc.
* Not to be used as a proxy for an adverse event report. See above for how it may be used as one component of an adverse event report.
* Not to be used for recording alerts. Alerts are handled using [Flag](file:///C:\temp\flag.html) or - where event-specific, [DetectedIssue](file:///C:\temp\detectedissue.html).
* Not to be used for recording failed therapy.

**STU Note:**Requests have been received (GF#10369) to add codes to the AllergyIntolerance.reaction.certainty value set (reaction-event-certainty), which is a required binding. The requested codes include "unknown", "ruled out" and "possible". The Patient Care WG has voted to add "unknown" to the value set, but recommends that if other terms (including "ruled out" and "possible") are desired for use in a specific setting, an extension or profile should be used. During the STU period [feedback](http://gforge.hl7.org/gf/project/fhir/tracker/) is solicited regarding (1) the need and desirability of adding the code "unknown" to the value set, vs. omitting the element if the certainty is not known; and (2) whether or not additional codes besides "unknown" should be added to the value set for the core specification, or whether additional codes, if needed, should be added in an extension/profile.

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**Negated Allergies and Intolerances**

It is important to differentiate between affirmatively stating that a patient has no known allergies versus either not including allergies in the record (for example an episodic document where the allergies are not considered relevant to the document); or asserting that allergies were not reviewed and are unknown.

Allergies with the verificationStatus "entered-in-error" indicates that the allergy or intolerance statement is entered by mistake and hence invalid.

Allergies with the verificationStatus "refuted" must be displayed to indicate that a reaction to a substance has been ruled out with the high level of clinical certainty (e.g. additional testing, rechallenging).

Prior to adding a new allergy/intolerance, a list of existing negated and refuted reactions should be reviewed and reconciled.

**Allergies Not Reviewed, Not Asked**

When a sending system does not have any information about allergies being reviewed or the statement is about allergies not being asked yet, then the [List](file:///C:\temp\list.html) resource should be used to indicate the List.emptyReason.code="notasked".

**Allergies Reviewed, None Identified**

Systems may use the List.emptyReason when a statement is about the full scope of the list (i.e. the patient has no known allergies or intolerances of any type). However, it is generally preferred to use a code for "No known allergies" (e.g., SNOMED CT: 716186003 |No known allergy (situation)|), so that all allergy data will be available and queryable from AllergyIntolerance resource instances. Negated AllergyIntolerance instances are also typically used when the record is more fine-grained (e.g. no drug allergies, no food allergies, no nut allergies, etc.).

However, it is possible to include negation statements that apply at the level of the whole list and it is also possible to have separate lists for things like medication allergies vs. food allergies, where that is appropriate to the architecture. Also note that care should be used when adding new AllergyIntolerances to a list to ensure that any negation statements that are voided by the addition of a new record are removed from the list. E.g. If the list contains a "no known food allergies" record and you add an "intolerance to grape flavor" record, then be sure you remove the "no known food allergies" record.

The substanceExposureRisk extension is also available for use as a more completely structured and flexible alternative to the 'code' element for representing positive and negative allergy and intolerance statements (either the 'code' element or the substanceExposureRisk extension may be used, but not both).

**STU Note:**There are two primary ways of reporting "no known allergies" in the current specification: using the CodeableConcept, as described above, or using the [List](file:///C:\temp\list.html) resource with emptyReason. The third available option is using the substanceExposureRisk extension. During the STU period, it is not recommended to use the [List](file:///C:\temp\list.html) resource for "no known allergies" reporting purposes. The principal reason for this is to allow all allergy or intolerance data to be found and to be consistently queryable from the single location of the AllergyIntolerance resource.[Feedback](http://gforge.hl7.org/gf/project/fhir/tracker/) is sought regarding the preferred approach.

No Known Allergies, using [List](file:///C:\temp\list.html).emptyReason (discouraged)

<List xmlns="http://hl7.org/fhir" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://hl7.org/fhir ..\..\schema\list.xsd">

<id value="example-empty-allergy"/>

<text>

<status value="generated"/>

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

<p> The patient is not aware of any allergies.</p>

</div>

</text>

<code>

<coding>

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

<code value="52472-8"/>

<display value="Allergies and Adverse Drug Reactions"/>

</coding>

<text value="Current Allergy List"/>

</code>

<source>

<reference value="Patient/example"/>

</source>

<status value="current"/>

<date value="2012-11-26T07:30:23+11:00"/>

<mode value="snapshot"/>

<emptyReason>

<coding>

<system value="http://hl7.org/fhir/special-values"/>

<code value="nil-known"/>

<display value="Nil Known"/>

</coding>

<text value="The patient is not aware of any allergies."/>

</emptyReason>

</List>

No Known Food Allergies and Medication Allergy List

<?xml version="1.0" encoding="UTF-8"?>

<List xmlns="http://hl7.org/fhir" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://hl7.org/fhir ..\..\schema\list.xsd">

<id value="current-allergies"/>

<text>

<status value="generated"/>

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

<p>Patient Peter Chalmers, DOB = Dec 25, 1974, MRN = 12345 (Acme Healthcare) has the following allergies</p>

<ul>

<li>No known food allergies</li>

<li>Allergenic extract, penicillin (high)</li>

</ul>

</div>

</text>

<code>

<coding>

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

<code value="52472-8"/>

<display value="Allergies and Adverse Drug Reactions"/>

</coding>

<text value="Current Allergy List"/>

</code>

<source>

<reference value="Patient/example"/>

</source>

<status value="current"/>

<date value="2015-07-14T23:10:23+11:00"/>

<mode value="snapshot"/>

<entry>

<item>

<reference value="AllergyIntolerance/nofoodallergies"/>

</item>

</entry>

<entry>

<item>

<reference value="AllergyIntolerance/penicillin"/>

</item>

</entry>

</List>

If a new allergy is discovered, the negated allergy record must be updated with the "refuted" verificationStatus - to ensure that systems referring to this record are aware that this is no longer true.

**Use of AllergyIntolerance.criticality**

Systems that only support one notion will have to determine whether what they're capturing is criticality or severity and map to the appropriate place. Criticality refers to the likelihood the allergy/intolerance could result in significant harm. Severity refers to the degree of manifestation of the reaction symptom. Moderate breathing difficulty would have high criticality while a severe rash would have low criticality. Severity is specific to a particular reaction occurrence.

For systems that only track generic reaction characteristics rather than a specific reaction will provide guidance to use the "reaction" structure and simply provide no date.

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**Scope and Usage**

CarePlan is one of the [request](file:///C:\temp\workflow.html#request) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

Care Plans are used in many areas of healthcare with a variety of scopes. They can be as simple as a general practitioner keeping track of when their patient is next due for a tetanus immunization through to a detailed plan for an oncology patient covering diet, chemotherapy, radiation, lab work and counseling with detailed timing relationships, pre-conditions and goals. They may be used in veterinary care or clinical research to describe the care of a herd or other collection of animals. In public health, they may describe education or immunization campaigns.

This resource takes an intermediate approach to complexity. It captures basic details about who is involved and what actions are intended without dealing in discrete data about dependencies and timing relationships. These can be supported where necessary using the extension mechanism.

The scope of care plans may vary widely. Examples include:

* Multi-disciplinary cross-organizational care plans; e.g. An oncology plan including the oncologist, home nursing staff, pharmacy and others
* Plans to manage specific disease/condition(s) (e.g. nutritional plan for a patient post bowel resection, neurological plan post head injury, pre-natal plan, post-partum plan, grief management plan, etc.)
* Decision support-generated plans following specific practice guidelines (e.g. stroke care plan, diabetes plan, falls prevention, etc.)
* Self-maintained patient or care-giver authored plans identifying their goals and an integrated understanding of actions to be taken

This resource can be used to represent both proposed plans (for example, recommendations from a decision support engine or returned as part of a consult report) as well as active plans. The nature of the plan is communicated by the status. Some systems may need to filter CarePlans to ensure that only appropriate plans are exposed via a given user interface.

**Boundaries and Relationships**

For simplicity sake, CarePlan allows the in-line definition of activities as part of a plan using the activity.detail element. However, activities can also be defined using references to the various "request" resources. These references could be to resources with a status of "planned" or to an active order. It is possible for planned activities to exist (e.g. appointments) without needing a CarePlan at all. CarePlans are used when there's a need to group activities, goals and/or participants together to provide some degree of context.

CarePlans can be tied to specific [Conditions](file:///C:\temp\condition.html) however they can also be condition-independent and instead focused on a particular type of care (e.g. psychological, nutritional) or the care delivered by a particular practitioner or group of practitioners.

An [ImmunizationRecommendation](file:///C:\temp\immunizationrecommendation.html) can be interpreted as a narrow type of Care Plan dealing only with immunization events. Where such information could appear in either resource, the immunization-specific resource is preferred.

CarePlans represent a specific plan instance for a particular patient or group. It is not intended to be used to define generic plans or protocols that are independent of a specific individual or group. CarePlan represents a specific intent, not a general definition. Protocols and order sets are supported through [PlanDefinition](file:///C:\temp\plandefinition.html).

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**Notes**

The [Provenance](file:///C:\temp\provenance.html) resource can be used for detailed review information, such as when the care plan was last reviewed and by whom.

**Open Issues**

**STU Note:** During the Trial use period, feedback is welcome on the following issue:

* At present, the patient element is optional to allow experimentation with care plan templates, though the resource was not designed for this use

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

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**Scope and Usage**

The Care Team resource includes all the people and/or organizations who plan to participate in the coordination and delivery of care for a patient. This is not limited to practitioners, but may include other caregivers such as family members, guardians, the patient themself, or others. The Care Team, depending on where used, may include care team members specific to a particular care plan, an episode, an encounter, or may reflect all known team members across these perspectives.

**Boundaries and Relationships**

Care Team is distinct from Group. Group is patient-independent and identifies an undifferentiated set of individuals who are intended to be the target of one or more clinical activities (e.g. set of clinical trial participants, set of individuals impacted by or at risk of a public health event, a herd or flock, etc.) The CareTeam resource establishes a set of relationships and roles and is specific to a particular Patient. The actors are the individual members or organized group of individuals. CareTeam can be referenced by EpisodeOfCare, Encounter, or CarePlan to identify the set of individuals (and their respective roles) who are intended to be involved in providing the care defined by those resources.

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**Notes**

The [Provenance](file:///C:\temp\provenance.html) resource can be used for detailed review information, such as when the care team was last reviewed and by whom.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\clinicalimpression\clinicalimpression-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\clinicalimpression\clinicalimpression-introduction.xml**

**Scope and Usage**

Performing a clinical assessment is a fundamental part of a clinician's workflow, performed repeatedly throughout the day. In spite of this - or perhaps, because of it - there is wide variance in how clinical impressions are recorded. Some clinical assessments simply result in an impression recorded as a single text note in the patient 'record' (e.g. "Progress satisfactory, continue with treatment"), while others are associated with careful, detailed record keeping of the evidence gathered and the reasoning leading to a differential diagnosis, and there is a continuum between these. This resource is intended to be used to cover all these use cases.

The assessment is intimately linked to the process of care. It may occur in the context of a care plan, and it very often results in a new (or revised) care plan. Normally. clinical assessments are part of an ongoing process of care, and the patient will be re-assessed repeatedly. For this reason, the clinical impression can explicit reference both care plans (preceeding and resulting) and reference a previous impression that this impression follows on from.

An impression is a clinical summation of information and/or an opinion formed, which is the outcome of the clinical assessment process. The ClinicalImpression may lead to a statement of a Condition about a patient.

In FHIR, an assessment is typically an instrument or tool used to collect information about a patient.

**STU Note:** Unlike many other resources, there is little prior art with regard to exchanging records of clinical assessments. For this reason, this resource should be regarded as particularly prone to ongoing revision. In terms of scope and usage, the Patient Care workgroup wishes to draw the attention of reviewers and implementers to the following issues:

* When is an existing clinical impression revised, rather than a new one created (that references the existing one)? How does that affect the status? what's the interplay between the status of the diagnosis and the status of the impression? (e.g. for a 'provisional' impression, which bit is provisional?)
* This structure doesn't differentiate between a working and a final diagnosis. Given an answer to the previous question, should it?
* Further clarify around the relationship between care plan and impression is needed. Both answers to the previous questions and ongoing discussions around revisions to the care plan will influence the design of clinical impression
* Should prognosis be represented, and if so, how much structure should it have?
* Should an impression reference other impressions that are related? (how related?)
* Investigations - the specification needs a good value set for the code for the group, and will be considering the name "investigations" further

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

**Boundaries and Relationships**

There is another related clinical concept often called an "assessment": assessment Tools such as Apgar (also known as "Assessment Scales"). This is not what the ClinicalImpression resource is about; assessment tools such as Apgar are represented as [Observations](file:///C:\temp\observation.html), and [Questionnaires](file:///C:\temp\questionnaire.html) may be used to help generate these. Clinical Impressions may refer to these assessment tools as one of the investigations that was performed during the assessment process.

**Background and Context**

An important background to understanding this resource is [the FHIR wiki page for clinical assessment](http://wiki.hl7.org/index.php?title=Clinical_Assessment). In particular, the storyboards there drove the design of the resource, and will be the basis for all examples created.

**PLANNED CHANGE:**

**ClinicalImpression** is one of the [Event](file:///C:\temp\workflow.html#event) resources in the FHIR [Workflow](file:///C:\temp\workflow.html) specification. As such, it is expected to be adjusted to align with the [Event](file:///C:\temp\event.html) workflow pattern which will involve adding a number of additional data elements and potentially renaming a few elements. Any concerns about performing such alignment are welcome as ballot comments and/or tracker items.

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**Known Issue**

A known issue exists with circular references between Condition and ClinicalImpression, which is due to the low maturity level of ClinicalImpression. The Patient Care work group intends to address this issue when ClinicalImpression is considered substantially complete and ready for implementation.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\communication\communication-examples-header.xml**

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**An introduction to this page as well as proper examples are to be submitted shortly.**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\communication\communication-introduction.xml**

**Scope and Usage**

Communication is one of the [event](file:///C:\temp\workflow.html#event) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource is a record of a communication. A communication is a conveyance of information from one entity, a sender, to another entity, a receiver. The sender and receivers may be patients, practitioners, related persons, organizations, or devices. Communication use cases include:

* A reminder or alert delivered to a responsible provider
* A recorded notification from the nurse that a patient's temperature exceeds a value
* A notification to a public health agency of a patient presenting with a communicable disease reportable to the public health agency
* Patient educational material sent by a provider to a patient

Non-patient specific communication use cases may include:

* A nurse call from a hall bathroom
* Advisory for battery service from a pump

**Boundaries and Relationships**

This resource is a record of a communication that has occurred. It does not represent the actual flow of communication. While [AuditEvent](file:///C:\temp\auditevent.html) can track electronic disclosures of information, it cannot track conversations, phone calls, letters and other interactions that are not system-to-system. And even for system-to-system communications, the specific end recipients may not be known. As well, [AuditEvents](file:///C:\temp\auditevent.html) are not considered to be "part" of the patient record, while **Communication** instances are. The **Communication** resource is not used as a general audit mechanism to track every disclosure of every record. Rather, it is used when a clinician or other user wants to ensure a record of a particular communication is itself maintained as part of the reviewable health record.

[Flag](file:///C:\temp\flag.html) resources represent a continuous ongoing "communication" alerting anyone dealing with the patient of certain precautions to take or issues to be aware of. The flags are continuously present as an ongoing reminder. This is distinct from **Communication** where there is a specific intended sender and receiver and the information is delivered only once.

**Communication and Encounter**

The Communication is about the transfer of information (which may or may not occur as part of an encounter), while Encounter is about the coming together (in person or virtually) of a Patient with a Practitioner. Communication does not deal with the duration of a call, it represents the fact that information was transferred at a particular point in time.

The phone calls involving the Patient should be handled using [Encounter](file:///C:\temp\encounter.html). Phone calls not involving the patient (e.g. between practitioners or practitioner to relative) that are tracked for billing or other purposes can use Communication to represent the information transferred, but are not ideal to represent the call itself. A better mechanism for handling such calls will be explored in a future release.

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**Notes to reviewers:**

*At this time, the code bindings are placeholders to be fleshed out upon further review by the community.*

**Communication.sender and Communication.recepient**

Communication.sender and Communication.recipient allow Patient|Practitioner|RelatedPerson - but it is not unusual to have a communication target - even a defined one - where it is unknown what kind of role the person is playing.

If the communication is to or from an individual, whose role is not known (practitioner, patient or related person), - for example, only email address is captured in the system; then RelatedPerson should be used by default.

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**An introduction to this page as well as proper examples are to be submitted shortly.**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\communicationrequest\communicationrequest-introduction.xml**

**Scope and Usage**

CommunicationRequest is one of the [request](file:///C:\temp\workflow.html#request) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource is a record of a request for a communication to be performed. A communication is a conveyance of information from one entity, a sender, to another entity, a receiver. The sender and receivers may be patients, practitioners, related persons, organizations, and devices. Uses of communication request include:

* A computer-based decision-support system requesting a reminder or alert be delivered to a responsible provider
* A physician requesting notification from the nurse if a patient's temperature exceeds a value
* A monitoring system or a provider requesting a staff member or department to notify a public health agency of a patient presenting with a communicable disease reportable to the public health agency
* A computer-based decision-support system proposes to send educational material to a patient

**Boundaries and Relationships**

This resource is a record of a request. It does not represent the actual flow of communication.

The use of **CommunicationRequest** excludes requests for referrals which are covered by the [ReferralRequest](file:///C:\temp\referralrequest.html) resource. It also excludes requests for therapy or counseling which would be handled by the [ProcedureRequest](file:///C:\temp\procedurerequest.html) resource. The performance of a **CommunicationRequest** may result in a [Communication](file:///C:\temp\communication.html) resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\communicationrequest\communicationrequest-notes.xml**

**Notes to reviewers:**

*At this time, the code bindings are placeholders to be fleshed out upon further review by the community.*

**CommunicationRequest.sender and CommunicationRequest.recepient**

CommunicationRequest.sender and CommunicationRequest.recipient allow Patient|Practitioner|RelatedPerson - but it is not unusual to have a communication target - even a defined one - where it is unknown what kind of role the person is playing.

If the communication request is to or from an individual, whose role is not known (practitioner, patient or related person), - for example, only email address is captured in the system; then RelatedPerson should be used by default.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\condition\condition-introduction.xml**

**Scope and Usage**

Condition is one of the [event](file:///C:\temp\workflow.html#event) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource is used to record detailed information about a condition, problem, diagnosis, or other event, situation, issue, or clinical concept that has risen to a level of concern. The condition could be a point in time diagnosis in context of an encounter, it could be an item on the practitionerâ€™s Problem List, or it could be a concern that doesnâ€™t exist on the practitionerâ€™s Problem List. Often times, a condition is about a clinician's assessment and assertion of a particular aspect of a patient's state of health. It can be used to record information about a disease/illness identified from application of clinical reasoning over the pathologic and pathophysiologic findings (diagnosis), or identification of health issues/situations that a practitioner considers harmful, potentially harmful and may be investigated and managed (problem), or other health issue/situation that may require ongoing monitoring and/or management (health issue/concern).

The condition resource may be used to record a certain health state of a patient which does not normally present a negative outcome, e.g. pregnancy. The condition resource may be used to record a condition following a procedure, such as the condition of Amputee-BKA following an amputation procedure.

While conditions are frequently a result of a clinician's assessment and assertion of a particular aspect of a patient's state of health, conditions can also be expressed by the patient, related person, or any care team member. A clinician may have a concern about a patient condition (e.g. anorexia) that the patient is not concerned about. Likewise, the patient may have a condition (e.g. hair loss) that does not rise to the level of importance such that it belongs on a practitionerâ€™s Problem List.

For example, each of the following conditions could rise to the level of importance such that it belongs on a problem or concern list due to its direct or indirect impact on the patientâ€™s health. These examples may also be represented using other resources, such as [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html), [Observation](file:///C:\temp\observation.html), or [Procedure](file:///C:\temp\procedure.html).

* Unemployed
* Without transportation (or other barriers)
* Susceptibility to falls
* Exposure to communicable disease
* Family History of cardiovascular disease
* Fear of cancer
* Cardiac pacemaker
* Amputee-BKA
* Risk of Zika virus following travel to a country
* Former smoker
* Travel to a country planned (that warrants immunizations)
* Motor Vehicle Accident
* Patient has had coronary bypass graft

**Boundaries and Relationships**

The condition resource may be referenced by other resources as "reasons" for an action (e.g. [MedicationRequest](file:///C:\temp\medicationrequest.html), [Procedure](file:///C:\temp\procedure.html), [ProcedureRequest](file:///C:\temp\procedurerequest.html), etc.)

This resource is not typically used to record information about subjective and objective information that might lead to the recording of a Condition resource. Such signs and symptoms are typically captured using the [Observation](file:///C:\temp\observation.html) resource; although in some cases a persistent symptom, e.g. fever, headache may be captured as a condition before a definitive diagnosis can be discerned by a clinician.

Use the [Observation](file:///C:\temp\observation.html) resource when a symptom is resolved without long term management, tracking, or when a symptom contributes to the establishment of a condition.

Use Condition when a symptom requires long term management, tracking, or is used as a proxy for a diagnosis or problem that is not yet determined.

When the diagnosis is related to an allergy or intolerance, the Condition and [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) resources can both be used. However, using Condition alone is not sufficient as the allergy or intolerance needs to be represented as an [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) to be actionable for decision support

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**Use of Condition.code**

Many of the code systems used for coding conditions will provide codes that define not only the condition itself, but may also specify a particular stage, location, or causality as part of the code. This is particularly true if SNOMED CT is used for the condition, and especially if expressions are allowed.

The Condition.code may also include such concepts asÂ "history of X" andÂ "good health", where it is useful or appropriate to make such assertions. It can also be used to capture "risk of" and "fear of", in addition to physical conditions, as well as "no known problems" or "negated" conditions (e.g., "no X" or "no history of X" - see the following section for "No Known Problems" and Negated Conditions).

When the Condition.code specifies additional properties of the condition, the other properties are not given a value - instead, the value must be understood from the Condition.code.

**"No Known Problems" and Negated Conditions**

**Conditions/Problems Not Reviewed, Not Asked**

When a sending system does not have any information about conditions/problems being reviewed or the statement is about conditions/problems not yet being asked, then the [List](file:///C:\temp\list.html) resource should be used to indicate the List.emptyReason.code="notasked".

**Conditions/Problems Reviewed, None Identified**

Systems may use the List.emptyReason when a statement is about the full scope of the list (i.e. the patient has no conditions/problems of any type). However, it may be preferred to use a code for "no known problems" (e.g., SNOMED CT: 160245001 |No current problems or disability (situation)|), so that all condition/problem data will be available and queryable from Condition resource instances.

Also note that care should be used when adding new Condition resources to a list to ensure that any negation statements that are voided by the addition of a new record are removed from the list. E.g. If the list contains a "no known problems" record and you add a "diabetes" condition record, then be sure that you remove the "no known problems" record.

**STU Note:**There are two primary ways of reporting "no known problems" in the current specification: using the CodeableConcept, as described above, or using the [List](file:///C:\temp\list.html) resource with emptyReason. During the STU period, [feedback](http://gforge.hl7.org/gf/project/fhir/tracker/) is sought regarding the preferred approach.

**Patient Denies Condition**

When the patient denies a condition, that can be annotated in the Condition.note element.

**Assertions of Condition Absence**

Generally, electronic records do not contain assertions of conditions that a patient does not have. There are however two exceptions:

* It is appropriate to capture a "refuted" Condition record if the patient or anyone else had reason to believe that a patient did have a condition for a period of time and subsequent evidence has demonstrated that belief was mistaken. In this case, a concrete statement acknowledging the belief as well as the refution of it is useful.
* It is common as part of checklists prior to admission, surgery, enrollment in trials, etc. to ask questions such as "are you pregnant", "do you have a history of hypertension", etc. This information should NOT be captured using the Condition resource but should instead be captured using QuestionnaireResponse or Observation. In this case, the combination of the question and answer would convey that a particular condition was not present.

**Use of Condition.evidence**

The Condition.evidence provides the basis for whatever is present in Condition.code.

**Use of Condition.abatementRange**

A range is used to communicate age period of subject at time of abatement.

**Use of Condition.asserter**

If the data enterer is different from the asserter and needs to be known, this could be captured using a Provenance instance pointing to the Condition. For example, it is possible that a nurse records the condition on behalf of a physician. The physician is taking responsibility, despite the nurse entering it into the medical record.

**Use of Condition.clinicalStatus**

The Condition.stage and Condition.clinicalStatus may have interdependencies. For example, some "stages" of cancer, etc. will be different for a remission than for the initial occurrence.

**Known Issue**

A known issue exists with circular references between Condition and ClinicalImpression, which is due to the low maturity level of ClinicalImpression. The Patient Care work group intends to address this issue when ClinicalImpression is considered substantially complete and ready for implementation.

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Examples of the Family History, using the [List](file:///C:\temp\list.html) resource:

* [Real-world patient example](file:///C:\temp\list-example-familyhistory-f201-roel.html)
* [Simple genetic family member history](file:///C:\temp\list-example-familyhistory-genetics-profile.html)
* [Example for risk assessment (The source picture can be checked as a binary file in the source xml or json file)](file:///C:\temp\list-example-familyhistory-genetics-profile-annie.html)
* [Example for double cousin relationship](file:///C:\temp\list-example-double-cousin-relationship-pedigree.html)

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For use cases, details on how this resource interact with other Clinical Genomics resources or profiles, please refer to implementation guidance document [here](file:///C:\temp\genomics.html).

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**Scope and Usage**

FamilyMemberHistory is one of the [event](file:///C:\temp\workflow.html#event) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource records significant health events and conditions for a particular individual related to the subject. This information can be known to different levels of accuracy. Sometimes the exact condition ('asthma') is known, and sometimes it is less precise ('some sort of cancer'). Equally, sometimes the person can be identified ('my aunt Agatha') and sometimes all that is known is that the person was an uncle.

This resource represents a simple structure used to capture an 'elementary' family history for a particular family member. However, it can also be the basis for capturing a more rigorous history useful for genetic and other analysis - refer to the [Genetic Pedigree](file:///C:\temp\familymemberhistory-genetic.html) profile for an example.

The entire family history for an individual can be represented by combining references to **FamilyMemberHistory** instances into a [List](file:///C:\temp\list.html) resource instance.

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**Processing information about the Family Member History**

The Family Member History [List](file:///C:\temp\list.html) may contain other than FamilyMemberHistory resources. For example, a full Family History could be a [List](file:///C:\temp\list.html) that might include a mixture of FamilyMemberHistory records as well as [Observation](file:///C:\temp\observation.html) records of things like "maternal family history of breast cancer", "number of siblings", "number of female family members with breast cancer" etc.

The [List](file:///C:\temp\list.html) representing a patient's "family history" can include [Condition](file:///C:\temp\condition.html) and [Observation](file:///C:\temp\observation.html) records that capture "family-history" relevant assertions about the patient themselves that would typically be captured as part of a family history.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\flag\flag-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\flag\flag-introduction.xml**

**Scope and Usage**

A flag is a warning or notification of some sort presented to the user - who may be a clinician or some other person involve in patient care. It usually represents something of sufficient significance to be warrant a special display of some sort - rather than just a note in the resource. A flag has a subject representing the resource that will trigger its display. This subject can be of different types, as described in the examples below:

* A note that a patient has an overdue account, which the provider may wish to discuss with them - in case of hardship for example (subject = Patient)
* An outbreak of Ebola in a particular region (subject=Location) so that all patients from that region have a higher risk of having that condition
* A particular provider is unavailable for referrals over a given period (subject = Practitioner)
* A patient who is enrolled in a clinical trial (subject=Group)
* Special guidance or caveats to be aware of when following a protocol (subject=PlanDefinition)
* Warnings about using a drug in a formulary requires special approval (subject=Medication)
* etc.

A flag is typically presented as a label in a prominent location in the record to notify the clinician of the potential issues, though it may also appear in other contexts; e.g. notes applicable to a radiology technician, or to a clinician performing a home visit. For patients, the information in the flag will often be derived from the record, and therefore, for a thorough and careful clinician, who has the time to review the notes will be redundant. However, given the volume of information frequently found in patients' records and the potentially serious consequences of losing sight of some facts, this redundancy is deemed appropriate. As well, some flags may reflect information not captured by any other resource in the record. (E.g. "Patient has large dog at home")

In line with its purpose, a flag is concise, highlighting a small set of high-priority issues among the much larger set of data in the chart. Readers who want more detail should consult the chart or other source of information. Caution should be exercised in creating Flag instances. If entries are created for information that could be gleaned in a sufficiently timely fashion by reviewing the patient record, the flag list will itself become overwhelming and will cease to serve its intended purpose.

Flags are expected to persist in a record for some period of time and are, at most, targeted to particular types of practitioners or to practitioners in particular system.

Examples of Patient related issues that might appear in flags:

* Risks to the patient (functional risk of falls, spousal restraining order, latex allergy)
* Patient's needs for special accommodations (hard of hearing, need for easy-open caps)
* Risks to providers (dog in house, patient may bite, infection control precautions)
* Administrative concerns (incomplete information, pre-payment required due to credit risk)

Examples of issues that should not appear **only** in flags:

* Potential allergy or drug interaction to planned therapy (use [DetectedIssue](file:///C:\temp\detectedissue.html))
* Known adverse reaction to a substance (use [AllergyIntolerance](file:///C:\temp\allergyintolerance.html))

Note that we include "latex allergy" in the "in scope" list, and "allergy" in the "not in scope" list. The Flag resource is not designed to replace the normal order checking process, and one should not expect to see all allergies in Flags. However, if there is an activity that might occur prior to careful evaluation of the record (e.g. donning of latex gloves) and that activity might pose a risk to the patient, that is the sort of eventuality the Flag is intended to support.

Specific guidelines about what type of information is appropriate to expose using Flag, as well as what categories of individuals should see particular flags, will vary by interoperability community.

**Boundaries and Relationships**

Flags may highlight a highly condensed view of information found in the [AllergyIntolerance](file:///C:\temp\allergyintolerance.html), [Condition](file:///C:\temp\condition.html), [Observation](file:///C:\temp\observation.html), [Procedure](file:///C:\temp\procedure.html) and possibly other resources. A [common extension](file:///C:\temp\extension-flag-detail.html) allows the linkage of a Flag to the supporting detail resource. The purpose of these other resources is to provide detailed clinical information. The purpose of a Flag is to alert practitioners to information that is important to influence their interaction with a Patient prior to detailed review of the record.

Flags are not used to convey information to a specific individual or organization (e.g. an abnormal lab result reported to the ordering clinician, reporting of an adverse reaction to a regulatory authority). These are handled using the [CommunicationRequest](file:///C:\temp\communicationrequest.html) and the [Communication](file:///C:\temp\communication.html) resources.

Flags are not raised as a result of a reported or proposed action (e.g. drug-drug interactions, duplicate therapy warnings). These would be handled using [DetectedIssue](file:///C:\temp\detectedissue.html).

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The Flag resource is sometimes known as "patient notes" and MAY be used to warn of issues such as:

* Issues that impact on the patient's ability to receive/respond to care the care provision process itself (e.g., poor language comprehension, low compliance expected)
* Issues that impact on the ability to provide care (e.g., patient has a big dog at home)
* Financial matters (e.g., patient is a bad debtor)

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\goal\goal-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\goal\goal-introduction.xml**

**Scope and Usage**

A Goal in health care services delivery is generally an expressed desired health state to be achieved by a subject of care (or family/group) over a period or at a specific point of time. This desired target health state may be achieved as a result of health care intervention(s) or resulting from natural recovery over time. For example:

* A goal of a plan for a condition such as a diabetes might specify desired outcome(s) (e.g. HgbA1c level =<5.6% in 3 months) as a result of interventions such as medication therapy, nutritional management and/or increase physical activity.
* A goal of a procedure might be to meet the intended objective of the procedure (e.g. wet-dry-dressing changes twice a day; goal: wound healed completely in 2 weeks) or to prevent an unintended complication (e.g. repositioning a patient every two hours: goal to maintain skin integrity)

Goals may address the prevention of illness, cure or mitigation of a condition, prolongation of life, or mitigation of pain and discomfort.

When dealing with groups, goals may also reflect health state, such as a reduction of addiction behaviors. However, they may also reflect population health objectives such as education, screening, etc.

Organizational goals are typically not health state specific but may instead identify measurement targets such as infection control, cost management, patient satisfaction, etc.

**Boundaries and Relationships**

Goals are typically established in the context of a [CarePlan](file:///C:\temp\careplan.html). However, goals may also be directly referenced by request-type resources (e.g. [MedicationRequest](file:///C:\temp\medicationrequest.html) or [ReferralRequest](file:///C:\temp\referralrequest.html)) by using an extension.

A goal represents a specific goal instance for a particular patient, group, etc. It is not intended to be used to define types of potential goals as part of an order set or protocol definition. Protocol definitions and order sets are supported through [PlanDefinition](file:///C:\temp\plandefinition.html). The Goal resource is intended to be used once an order set is instantiated or assigned to a patient, which is when the potential goals become the actual goals, if not changed or deleted.

Goals are often evaluated using [Observations](file:///C:\temp\observation.html).

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\linkage\linkage-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\linkage\linkage-introduction.xml**

**Scope and Usage**

This resource allows the assertion of linkages between multiple resource instances (generally of the same type) that are referring to the same underlying business objects. For example, multiple Condition records that refer to the same underlying problem/issue for a particular Patient; multiple AllergyIntolerance records that refer to the same reaction susceptibility; multiple Patient, Practioner and/or RelatedPerson records that refer to the same human being or animal.

FHIR supports a process for sharing electronic records. It is common for multiple records to exist that deal with the same real-world phenomenon. This can result from information being captured by different systems, information being captured within a single system by different users (either deliberately to represent distinct perspectives or accidentally when a new record is created rather than updating an existing record). These multiple records may be referred to as "duplicate" records, but in practice they aren't often actually "duplicate" in that the data represented (and the history of the records) will be at least somewhat distinct.

In some cases, the solution upon identifying duplicates is to deprecate one of the records (e.g. by changing the status to "entered in error") and move all relevant information to the surviving record. In other cases, the resource may support the ability to establish a linkage directly between the resources. However, in some cases, both records may need to survive or there's a desire to have both resources continue to be maintained, perhaps because the resources live on different servers or have different 'owners'. The **Linkage** resource is intended to satisfy this use-case.

**Boundaries and Relationships**

The [Person](file:///C:\temp\person.html) resource should be used to link a person independent of a specific health-related context. Linkage can be used for all other use cases.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\procedure\procedure-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\procedure\procedure-introduction.xml**

**Scope and Usage**

Procedure is one of the [event](file:///C:\temp\workflow.html#event) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource is used to record the details of procedures performed on a patient. A procedure is an activity that is performed with or on a patient as part of the provision of care. Examples include surgical procedures, diagnostic procedures, endoscopic procedures, biopsies, counseling, physiotherapy, exercise, etc. Procedures may be performed by a healthcare professional, a friend or relative or in some cases by the patient themselves.

This resource provides summary information about the occurrence of the procedure and is not intended to provide real-time snapshots of a procedure as it unfolds, though for long-running procedures such as psychotherapy, it could represent summary level information about overall progress. The creation of a resource to support detailed real-time procedure information awaits the identification of a specific implementation use-case to share such information.

**Boundaries and Relationships**

The Procedure resource should not be used to capture an event if a more specific resource already exists - i.e. [immunizations](file:///C:\temp\immunization.html), [drug administrations](file:///C:\temp\medicationadministration.html) and [communications](file:///C:\temp\communication.html). The boundary between determining whether an action is considered to be training or counseling (and thus a procedure) as opposed to a Communication is based on whether there's a specific intent to change the mind-set of the patient. Mere disclosure of information would be considered a Communication. A process that involves verification of the patient's comprehension or to change the patient's mental state would be a Procedure.

Note that many diagnostic processes are procedures that generate [Observations](file:///C:\temp\observation.html) and [DiagnosticReports](file:///C:\temp\diagnosticreport.html). In many cases, such an observation does not require an explicit representation of the procedure used to create the observation, but where there are details of interest about how the diagnostic procedure was performed, the procedure resource is used to describe the activity.

Some diagnostic procedures may not have a Procedure record. Â The Procedure record is only necessary when there is a need to capture information about the physical intervention that was performed to capture the diagnostic information (e.g. anesthetic, incision, scope size, etc.)

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**Use of Procedure properties**

Many of the elements of Procedure have inherent relationships and may actually all be conveyed by the Procedure.code or in the text element of the Procedure.code property. I.e. You may be able to infer category, bodySite and even indication. Whether these other properties will be populated may vary by implementation.

Care should be taken to avoid nonsensical combinations/statements; e.g. "name=amputation, bodySite=heart"

**Use of Procedure.used**

For devices, these are devices that are incidental to / or used to perform the procedure - scalpels, gauze, endoscopes, etc. Devices that are the focus of the procedure should appear in Procedure.device instead.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\questionnaire\questionnaire-extensions-introduction.xml**

**Scope and Usage**

The core extensions provide HL7 provided extensions to the [Questionnaire](file:///C:\temp\questionnaire.html) resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\questionnaire\questionnaire-extensions-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\questionnaire\questionnaire-introduction.xml**

**Scope and Usage**

A **Questionnaire** is an organized collection of questions intended to solicit information from patients, providers or other individuals involved in the healthcare domain. They may be simple flat lists of questions or can be hierarchically organized in groups and sub-groups, each containing questions. The **Questionnaire** defines the questions to be asked, how they are ordered and grouped, any intervening instructional text and what the constraints are on the allowed answers. The results of a **Questionnaire** can be communicated using the [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) resource.

Questionnaires cover the need to communicate data originating from forms used in medical history examinations, research questionnaires and sometimes full clinical specialty records. In many systems this data is collected using user-defined screens and forms. Questionnaires define specifics about data capture - exactly what questions were asked, in what order, what choices for answers were, etc. Each of these questions is part of the Questionnaire, and as such the Questionnaire is a separately identifiable Resource, whereas the individual questions are not.

Examples of Questionnaires include:

* Past medical history (PMH)
* Family diseases
* Social history
* Research questionnaires/Clinical research forms (CRFs)
* Quality and evaluation forms
* Patient intake form (e.g. clipboard)
* Insurance claim form

This resource is limited in scope to support the characteristics of simple questionnaires. However, common extensions have been defined to allow more sophisticated behavior. This includes:

* [Questionnaire core extensions](file:///C:\temp\questionnaire-extensions.html) which defines the additional descriptive characteristics for questionnaires and their groups and questions
* [Element extensions](file:///C:\temp\element-extensions.html) which can describe additional constraints on allowed answers for questionnaires such as string length and date and numeric ranges

Additional profiles such as the [Structured Data Capture Questionnaire profile](http://hl7.org/fhir/us/sdc/questionnaire-sdc.html) may provide additional capabilities for defining more sophisticated questionnaires and forms.

**Boundaries and Relationships**

**Questionnaires** differ from [Lists](file:///C:\temp\list.html) because [Lists](file:///C:\temp\list.html) group existing resources, while **Questionnaires** group arbitrary questions. In theory, a **Questionnaire** could be expressed as a [List](file:///C:\temp\list.html) or [Composition](file:///C:\temp\composition.html) containing [DataElement](file:///C:\temp\dataelement.html) resources. However, the former would disregard the "wholeness" associated with a questionnaire where questions must generally be maintained as a single structure. The latter would focus on rendering of the data elements rather than organizing the capture of information.

**PLANNED CHANGE:**

**Questionnaire** is one of the [Definition](file:///C:\temp\workflow.html#definition) resources in the FHIR [Workflow](file:///C:\temp\workflow.html) specification. As such, it is expected to be adjusted to align with the [Definition](file:///C:\temp\definition.html) workflow pattern. Any concerns about performing such alignment are welcome as ballot comments and/or tracker items.

**Background and Context**

Groups and questions that make up a Questionnaire can be explicitly coded to refer to externally defined numbering or identification of questions and sections on formally defined questionnaires. This allows extraction of the data on a form and post-processing of the data contained in a Questionnaire. Such coding is not required however and Questionnaires may be quite loosely defined. The section [Questionnaire versus Resources](file:///C:\temp\intros%20and%20notes.html#qversusr) below discusses the issues of collecting data in such loosely defined Questionnaires versus collecting data as well-defined separate Resources.

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**Notes:**

* Questionnaires may be used to represent predefined forms or panels, referenced using items of type "group"
* Questions may be nested. The Questionnaire resource supports nested items beneath both items of type "group" (which doesn't capture an answer of its own) as well as beneath questions
* Groups and Questions may have linkIds allowing groups and question answers captured in a [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) to be associated with their corresponding group or question.
* Questionnaire allows for flexible naming and structuring of its contents to reflect the flexible and varying nature of forms and questionnaires. It explicitly does not try to standardize or streamline exchange of its contents outside its context of use, although exchanging partners may further constrain its structure and flexibility using profiles to define standardized, reusable forms.
* Because of the lack of explicit support for Questionnaires in [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186), [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) Documents frequently used named sections with Observations to model Questionnaires. Such use cases should now use the Questionnaire Resource instead.
* The order of questions within groups, groups within groups and groups within questions is relevant and must be retained for display and capture.
* Display items allow the inclusion of instructions, background information and similar content within a questionnaire.

**Using Questionnaires versus using Resources**

There is considerable overlap between the information covered by **Questionnaires** and other Resources (especially [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html), [MedicationStatement](file:///C:\temp\medicationstatement.html), [Observation](file:///C:\temp\observation.html), [Procedure](file:///C:\temp\procedure.html), etc.): **Questionnaire's** flexible structure can easily be misused to capture any data, even data that should be captured as separate Resources. The choice between using **Questionnaires** or separate Resources may be dictated by the procedure of collection and recording; e.g. if the data is captured as a physician-agreed (electronic) form, it might be impossible or undesirable to distill separate resources from it and capturing the data in a **Questionnaire** would be most appropriate.

However, data captured only in **Questionnaires** can be difficult to query after-the-fact. Queries against other Resources will not return data captured only in **Questionnaires**, and querying against **Questionnaires** directly may not find all desired data, depending on how the questions may have been phrased or encoded over time or by different clinicians. Moreover, interoperability of such **Questionnaires** is limited, as interpretation of its contents is only known to the circle of parties that were involved in its definition: encoding data from such **Questionnaires** using other, more specific, Resources increases the ability and consistency with which it can be understood and queried.

It is entirely possible for data to exist in both QuestionnaireResponse and in other resources. For example, data may be captured in [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) as part of an intake questionnaire. That data may then be propagated into the [Patient](file:///C:\temp\patient.html) resource (demographics), [FamilyMemberHistory](file:///C:\temp\familymemberhistory.html), [AllergyIntolerance](file:///C:\temp\allergyintolerance.html), [MedicationStatement](file:///C:\temp\medicationstatement.html) and [Observation](file:///C:\temp\observation.html) resources to allow the data to be queried and analyzed. The original [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) instance can be retained for traceability purposes. If desired, a [Provenance](file:///C:\temp\provenance.html) resource can be used to identify the Questionnaire as the data source for the other resources. For example, if a questionnaire question asks "what is your weight", that can then result in the creation of an [Observation](file:///C:\temp\observation.html) with the appropriate Observation.code and the specified answer as the Observation.valueQuantity.

**Structure of the Questionnaire**

A Questionnaire is built out of two components:

* The main component is Questionnaire, which holds information *about* the Questionnaire, like the identifier, publisher, date authored, title, etc. The Questionnaire contains zero or more items which define the content of the questionnaire. (Zero items allows for the possibility of narrative-only questionnaires, though obviously these provide little computable information.)
* Items have one of three sub-types, distinguished by the type element:
  + **display** items convey text to be rendered on the form that won't capture data and which won't contain nested items. This might include copyright or authorship information, instructions or other background.
  + **group** items organize content of the questionnaire into sections, sub-sections, etc. Groups don't have answers associated with them directly, but generally contain child 'question' items which do.
  + *question* items ask a specific question to which an answer may be given. There isn't a single type for question items. Instead, the type conveys the data type of the answer for the question. If an item isn't a 'display' or a 'group', then it's a question. and actual "question" information which allows a particular type of answer to be gathered (and which may also have nested items). Questions may also have nested content - groups and/or other questions. This way, one can model "panels" of questions which would only be relevant (and thus would only be displayed) depending on the answers of a parent question; e.g. a question "Did the patient receive treatment in the past six months?" would contain a nested group of questions asking for further details about the treatment. See an [example](file:///C:\temp\questionnaire-example-bluebook.xml.html) from the [Australian New South Wales blue book](http://www.health.nsw.gov.au/Kids/Publications/my-personal-health-record.pdf)

Specific controls on dynamic display of groups, questions, etc. based on the answers to other questions is outside the scope of the base resource and are handled using extensions.

**Identifiers within Questionnaire**

There are three different "identifying" elements within Questionnaire: identifier, id and linkId. Each serves very distinct purposes:

* **identifier** is used to reference the overall questionnaire in business terms. It is the number printed across the top of the form or listed beside the form when making a choice between alternate forms.
* The **id** attribute supported on each element is used for references within a resource, for example linking narrative to discrete elements. Ids are not generally displayed to end users
* The **linkId** element on questions and groups establishes a link between elements in a [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) and their definition inside a Questionnaire. This is the *only* way to link between the groups and questions in a Questionnaire and QuestionnaireResponse. These are also not displayed to end users

**Question Definitions**

Questionnaires can be crafted using any questions the author can conceive phrased in whatever manner is appropriate or convenient. However, standardization of questions and the constraints enforced on the accompanying answers increases the ability to compare data gathered across questionnaires. Items can be directly linked to an [ElementDefinition](file:///C:\temp\elementdefinition.html) using Questionnaire.item.definition which provides details for the item. If a definition is provided, then the following element values can be derived from the definition:

* concept (from ElementDefinition.code)
* type (from ElementDefinition.type)
* required (from ElementDefinition.min)
* repeats (from ElementDefinition.max)
* maxLength (from ElementDefinition.maxLength)
* options (from ElementDefinition.binding)

Any information provided in these elements overrides the information from the definition. The url refers to a an ElementDefinition in either a [StructureDefinition](file:///C:\temp\structuredefinition.html) or a [DataElement](file:///C:\temp\dataelement.html), and always starts with the canonical URL for the target resource. When referring to a StructureDefinition, a fragment identifier is used to specify the element definition by it's id (Element.id). E.g. http://hl7.org/fhir/StructureDefinition/Observation#Observation.value[x]. In the absence of a fragment identifier, the first/root element definition in the target is the matching element definition.

Note that [LOINC codes](file:///C:\temp\loinc.html#dataelements) implicitly define DataElement resources.

The definitions may also be used to automatically pre-populate answers, or extract data from a corresponding [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) resource.

NOTE: Even if a standard question definition is provided, information such as the question text, data type and value set SHOULD still be declared for the question. Systems processing the questionnaire may not have access to or support the ability to look up the question definitions from external sources. If the information is not included in-line within the questionnaire, other systems may not be able to to render or use the Questionnaire.

If an external definition is included along with question information such as question text, data type or value set, it is expected that the content for the question and the referenced definition would be in alignment. However, FHIR does not dictate what degree of alignment is required; e.g. Does the question text need to match exactly? Is it legitimate for a question to constrain the allowed value set of possible answers? These rules will need to be established within implementation environments.

**Question types**

The codes for the data type for each question are slightly different than the data types allowed in the [QuestionnaireResponse](file:///C:\temp\questionnaireresponse.html) resource. Where the names are the same (ignoring case), the "answer" must use the specified type. Where the names are different, the mappings are as follows:

|  |  |
| --- | --- |
| **Questionnaire AnswerFormat code** | **QuestionnaireResponse data type** |
| text | string |
| url | uri |
| choice | Coding |
| open-choice | Coding |

**Permitted values for questions**

Many questionnaires place constraints on the allowed list of values for a given question. FHIR supports this notion through the item.options or the item.option element.

The "choice" mechanism is simplest - all options are listed in-line with the question. Maintenance of the set of permitted question answers involves maintenance of the questionnaire itself.

The "choices" mechanism is more sophisticated. Rather than listing the choices directly, the choices element points to a [ValueSet](file:///C:\temp\valueset.html) resource. This approach adds complexity for questionnaires having a simple list of strings as choices for a question, but provides several benefits:

* Questionnaires that reference codes from externally defined code systems have a means of doing so
* Answer sets can be shared across questions (and there are many questionnaires where this capability is useful)
* The full capability of value sets can be brought into play, including the ability to use ConceptMap to link and translate from questionnaire-specific codes to other codes, the use of multiple display names (e.g. different languages), the ability to use coded ordinals, the ability to allow choices from larger value sets (e.g. "all SNOMED CT procedure codes")
* etc.

In many cases, the set of code choices will be specific to a given questionnaire and should be maintained as part of the questionnaire. In this case, the referenced ValueSet can be included as a [contained](file:///C:\temp\references.html#contained) resource. All contained ValueSets are listed together and then are referenced by the individual questions as necessary. Alternatively, the "choices" element can reference the value set in a version-specific manner. This ensures that the Questionnaire will not adopt a new version of the referenced value set without revising the Questionnaire to point to that new version - putting the author of the Questionnaire in control of any changes.

**Useful Value Sets**

Many questions have a set of possible codes for their answer. These value sets may be useful to help, and when referenced by full URL, do not need to be provided as part of the questionnaire:

* [Yes | No | Don't Know](file:///C:\temp\valueset-example-yesnodontknow.html): http://hl7.org/fhir/ValueSet/yesnodontknow

**Questions with multiple answer types**

In some questionnaires, it may be possible to respond to a question with multiple types of answers. For example, capturing a coded answer plus free text, capturing a coded value plus a numeric priority, etc. In FHIR, this is handled through nested questions. Each question has a single data type. However, each question can have nested child questions. These nested child questions can have text (e.g. "Please specify") or can have no text at all if the appropriate guidance is provided by the parent question or group.

**Questionnaires with Math**

While not defined (yet) as part of the FHIR specification, extensions may be defined to perform mathematical functions on questionnaire responses. For example, tabulating scores. One extension that is defined that may be useful in this process is the Ordinal extension. This allows a numeric value to be associated with a coded data element. There are two extensions defined - one for defining the numeric weighting of a code defined in a value set - [valueset-ordinalValue](file:///C:\temp\extension-valueset-ordinalvalue.html) and the other is a code that can appear within a Coding itself - [iso21090-CO-value](file:///C:\temp\extension-iso21090-co-value.html).

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\questionnaireresponse\questionnaireresponse-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\questionnaireresponse\questionnaireresponse-introduction.xml**

**Scope and Usage**

**QuestionnaireResponse** provides a complete or partial list of answers to a set of questions filled when responding to a questionnaire. The questions may be included directly or by reference to a [Questionnaire](file:///C:\temp\questionnaire.html) resource that defines the questions as well as the constraints on the allowed answers. In some cases, both formal rules for editing the questionnaire (via link to [Questionnaire](file:///C:\temp\questionnaire.html)) as well as sufficient local information to allow rendering of the questionnaire may be provided.

Each time a questionnaire is completed for a different subject or at a different time, a distinct QuestionnaireResponse is generated, though it may be possible for a previously entered set of answers to be edited or updated.

Questionnaire responses cover the need to communicate data originating from forms used in medical history examinations, research questionnaires and sometimes full clinical specialty records. In many systems this data is collected using user-defined screens and forms. Questionnaire responses record specifics about data capture - exactly what questions were asked, in what order, what choices for answers were, etc. Each of these questions is part of the Questionnaire, and as such the Questionnaire is a separately identifiable Resource, whereas the individual questions are not.

Examples of Questionnaires include:

* Past medical history (PMH)
* Family diseases
* Social history
* Research questionnaires and Case report forms (CRFs)
* Quality and evaluation forms
* Patient intake form (e.g. clipboard)
* Insurance claim form

**QuestionnaireResponse** resources can be validated against their corresponding [Questionnaire](file:///C:\temp\questionnaire.html) to verify that required groups and questions are answered and that answers fit constraints in terms of cardinality, data type, etc.

**Boundaries and Relationships**

The **QuestionnaireResponse** resource captures the responses to a questionnaire, while [Questionnaire](file:///C:\temp\questionnaire.html) represents the definition of the questionnaire form, including what questions are asked, how they're organized and the constraints on the allowed answers.

While [Observation](file:///C:\temp\observation.html), with its nested relatedObservation structure, can create complex hierarchies of questions and answers, the focus is different. First, [Observation](file:///C:\temp\observation.html) is used primarily for capturing data elements that are "true" observations - lab measurements, vital signs, social assessments, etc. On the other hand, **QuestionnaireResponse** can be used to capture any types of data, including data that would typically map to other resources ([Procedure](file:///C:\temp\procedure.html), [Patient](file:///C:\temp\patient.html), [MedicationStatement](file:///C:\temp\medicationstatement.html), etc.) In addition, the focus of **QuestionnaireResponse** includes the specific phrasing and organization of the questions. All data must be explicitly captured as a question. With [Observation](file:///C:\temp\observation.html), the focus is only on the meaning of the answer, not what question was asked (assuming a question was even asked at all). Additional information such as normal ranges, interpretation, date, etc. may also be captured.

**PLANNED CHANGE:**

**QuestionnaireResponse** is one of the [Event](file:///C:\temp\workflow.html#event) resources in the FHIR [Workflow](file:///C:\temp\workflow.html) specification. As such, it is expected to be adjusted to align with the [event](file:///C:\temp\event.html) workflow pattern. Any concerns about performing such alignment are welcome as ballot comments and/or tracker items.

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**Notes**

* QuestionnaireResponses can be authored by clinicians, the patient or a patient's relatives (or even the owner in the case of animals). Clinicians may author questionnaire responses, where the answers are provided by others on behalf of the patient. Additionally, information gathered for the purpose of a patient may be about the patient's relatives (e.g. in family anamnesis). Therefore, QuestionnaireResponse makes a distinction between the author, the subject and the source of information.
* A QuestionnaireResponse may be stand-alone or may point to the form that defines the questions in [Questionnaire](file:///C:\temp\questionnaire.html). In this second case, the linkage between the questions and groups in the two resources is established using the linkId element.
* If a QuestionnaireResponse references a Questionnaire, then the QuestionnaireResponse structure must be consistent with the Questionnaire (i.e. questions must be organized into the same groups, nested questions must still be nested, etc.)
* Because of the lack of explicit support for Questionnaires in [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186), [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) Documents frequently used named sections with Observations to model questionnaires. Such use cases should now utilize the QuestionnaireResponse resource instead.
* The QuestionnaireResponse's *encounter* element can be used to link to the encounter when the questionnaire response was authored. This can be relevant since the encounter gives context to the answers and can be used to relate information in the QuestionnaireResponse to orders and observations that were done during the same Encounter.
* The order of questions within groups, groups within groups and groups within questions is relevant and must be retained for display and capture.
* Typically [Questionnaire](file:///C:\temp\questionnaire.html) items of type *display* are not mirrored in a QuestionnaireResponse as the purpose of a QuestionnaireResponse is to reflect the information entered into the form, not the instructions provided, though questions and group headings are retained to ensure that the meaning of answers can be interpreted independent of the Questionnaire.

Refer to additional guidance provided in the [Questionnaire](file:///C:\temp\questionnaire.html) resource dealing with the design of questionnaires.

**Security**

QuestionnaireResponse resources can have answers with values of type Attachment. These attachments will typically be selected by the user answering the questionnaire and this selection may be done in an uncontrolled environment. Systems should ensure that the attachment is of the desired type and should take precautions before rendering or executing any attached content.

**Access Control**

For most resources, the type of information that can be conveyed in the resource is determined by the resource, and the key attributes that determine the sensitivity level of the information are also known; e.g., drug, observation type, clinical trial randomization status, etc. However, for QuestionnaireResponse, the sensitivity of an instance is dependent on what type of Questionnaire it is associated with. And the data elements that determine that sensitivity could be the answers to any of the questions. This makes automatically enforcing access control rules more challenging. Designers should take these challenges into account and may need to place stricter access controls around QuestionnaireResponse to ensure that access to information is not granted improperly.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\referralrequest\referralrequest-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\referralrequest\referralrequest-introduction.xml**

**Scope and Usage**

ReferralRequest is one of the [request](file:///C:\temp\workflow.html#request) resources in the FHIR [workflow](file:///C:\temp\workflow.html) specification.

This resource is used to share relevant information required to support a referral request or a transfer of care request from one practitioner or organization to another. It is intended for use when a patient is required to be referred to another provider for a consultation/second opinion and/or for short term or longer term management of one or more health issues or problems.

Examples include:

* Request for a consult from a specialist
* Referral for support from community services
* District nursing services referral
* Request for Aged care placement assessment
* Request for a pharmacist medication review
* Referral for physiotherapy or occupational therapy

ReferralRequest is also intended for use when there is a complete and more permanent transfer of care responsibility from one practitioner/organization to another (for example, as in the case of requesting the transfer of care for a patient from an acute care setting to rehabilitation, aged care, or a skilled nursing facility).

**Boundaries and Relationships**

ReferralRequest is closely related to other types of "request" resources, particularly [ProcedureRequest](file:///C:\temp\procedurerequest.html). In fact, for some services, it may be appropriate to use any one of these resources to request that the service be performed. Which one is used may be driven by organizational practice and by context. When it is unclear which to use, the following principles may be helpful:

* ProcedureRequest is typically used when the requesting clinician has and wishes to exercise the authority (and expertise) to decide exactly what action will be done.
* A ReferralRequest is used when the requesting practitioner is seeking another practitioner or organization to use their own expertise and/or authority to determine the specific action to take.
* Whether an activity is deemed to be a procedure or only a diagnostic request is typically driven by how invasive the diagnostic process is. More invasive processes are typically represented as procedures, though the dividing line may vary by organization.

Irrespective of the guidance above, systems should be prepared for some degree of overlap between these resources and should be prepared to execute searches against multiple resources in cases where differentiation cannot be guaranteed. As well, in some workflows more than one type of resource or even both might exist; E.g., upon receiving a ReferralRequest a practitioner might initiate a ProcedureRequest.

A "referral" is often thought of as a document that contains a great deal of information about the patient being referred. This resource does not actually contain the clinical background information for the patient. Instead, it supports references to the numerous other resources that define this information. For example, Condition, Family History, Allergy/Intolerance, Alerts, Medication, Diagnostic Reports, etc. Alternatively, some systems may choose to bundle up a ReferralRequest and this referenced information into a [Document](file:///C:\temp\documents.html) for delivery to the recipient. However, [REST](file:///C:\temp\http.html),[Messaging](file:///C:\temp\messaging.html) and [Services](file:///C:\temp\services.html) are also valid architectures for managing referrals and may be more appropriate where active workflow management is needed.

The details of the type of care desired as part of a referral may be conveyed using any of the "request" or "order" resources, likely with a status of "proposed". The [CarePlan](file:///C:\temp\careplan.html) resource can be used to describe more sophisticated requests for combinations of services. Likewise, ReferralRequest may be referenced as part of a CarePlan.

A ReferralRequest may be targeted (identifying a specific Practitioner or Organization to perform the requested care) or untargeted (merely identifying the type of care desired). The [Task](file:///C:\temp\task.html) resource may be used to help manage such workflows.

A ReferralRequest might be fulfilled by a [DiagnosticReport](file:///C:\temp\diagnosticreport.html), [Encounter](file:///C:\temp\encounter.html), [Procedure](file:///C:\temp\procedure.html), or other assessment-related resource.

A ReferralRequest should not be confused with an [Appointment](file:///C:\temp\appointment.html), as appointments are intended for booking/scheduling purposes.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunization\immunization-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunization\immunization-introduction.xml**

**Scope and Usage**

The Immunization resource is intended to cover the recording of current and historical administration of vaccines to patients across all healthcare disciplines in all care settings and all regions. This includes immunization of both humans and animals, but does not include the administration of non-vaccine agents, even those that may have or claim to have immunological effects.

Additionally, the Immunization resource is expected to cover key concepts related to the creation, revision and querying of a patient's immunization history. This resource - through consultation with the PHER work group - is believed to meet key use cases and information requirements as defined in the existing [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) immunization implementation guide, [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) POIZ domain and Immunization Domain Analysis Model.

**Boundaries and Relationships**

This resource references the following resources:

* Patient
* Practitioner
* Organization
* Location
* Observation
* Encounter

Administration of vaccines is intended to be handled using the **Immunization** resource. [MedicationAdministration](file:///C:\temp\medicationadministration.html) is intended for tracking the administration of non-vaccine medications. Some systems treat immunizations in the same way as any other medication administration. Such systems SHOULD use an immunization resource to represent these. If systems need to use a [MedicationAdministration](file:///C:\temp\medicationadministration.html) resource to capture vaccinations for workflow or other reasons, they SHOULD also expose an equivalent **Immunization** instance.

**AllergyIntolerance and Immunization.reaction**

[Immunization.reaction](file:///C:\temp\immunization-definitions.html#Immunization.reaction) may be an indication of an allergy or intolerance. If this is deemed to be the case, a separate [AllergyIntolerance](file:///C:\temp\allergyintolerance.html) resource instance should be created to indicate it, as most systems will not query against past Immunization.reaction.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunization\immunization-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunizationrecommendation\immunizationrecommendation-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunizationrecommendation\immunizationrecommendation-introduction.xml**

**Scope and Usage**

The ImmunizationRecommendation resource is intended to cover communication of a specified patient's immunization recommendations and status across all healthcare disciplines in all care settings and all regions.

Additionally, the ImmunizationRecommendation resource is expected to cover key concepts related to the querying of a patient's immunization recommendations and status. This resource - through consultation with the PHER work group - is believed to meet key use cases and information requirements as defined in the existing [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) POIZ domain and Immunization Domain Analysis Model.

**Boundaries and Relationships**

This resource references the following resources:

* Allergy/Intolerance
* Patient
* Organization
* Immunization
* Observation

One of the considerations for this resource is if it is better for this resource to be a profile of the CarePlan resource, or if it is more appropriate for this to be a separate resource due to the number of immunization profile-specific data elements.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\immunizationrecommendation\immunizationrecommendation-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\medication\medication-examples-header.xml**

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The following are examples of Medication resources where the medication is a manufactured product:

* [IV injection (inpatient order) - Manufactured Product - Vancomycin](file:///C:\temp\medicationexample0301.html)
* [IV Injection - Manufactured Product - Piperacillin](file:///C:\temp\medicationexample0302.html)
* [IV Chemotherapy Example - Manufactured Product - Alemtuzumab](file:///C:\temp\medicationexample0303.html)
* [Oral Chemotherapy Example - Manufactured Product - Myleran](file:///C:\temp\medicationexample0304.html)
* [Eye Drop Example - Manufactured Product - Timoptic](file:///C:\temp\medicationexample0305.html)
* [IV Chemotherapy Example - Manufactured Product - Adcetris](file:///C:\temp\medicationexample0306.html)
* [Subcutaneous injection Example - Manufactured Product - Novolog](file:///C:\temp\medicationexample0307.html)
* [As needed Oral tablet - Manufactured Product - Percocet](file:///C:\temp\medicationexample0308.html)
* [Over the Counter Product - Manufactured Product - Tylenol PM](file:///C:\temp\medicationexample0309.html)
* [Oral Chemotherapy Example - Manufactured Product - Xeloda - includes a reference to a substance in ingredient element](file:///C:\temp\medicationexample15.html)

The following are examples of Medication resources where the medication is a generic formulation (ie, represents an ingredient or set of ingredients plus dosage form)

* [Generic Formulation - Oxycodone](file:///C:\temp\medicationexample0310.html)
* [Generic Formulation - Prednisone 5mg tablet](file:///C:\temp\medicationexample0311.html)
* [Generic Formulation - Nystatin 100,000u/ml](file:///C:\temp\medicationexample0312.html)
* [Generic Formulation - Lorazepam 2mg/ml injection](file:///C:\temp\medicationexample0313.html)
* [Generic Formulation - Alprazolam 0.25mg tablet](file:///C:\temp\medicationexample0314.html)
* [Generic Formulation - Mometasone Furorate 0.05mg/Actuat](file:///C:\temp\medicationexample0315.html)
* [Generic Formulation - Fully populated example of a Medication - Chlorthalidone](file:///C:\temp\medicationexample0316.html)
* [Generic Formulation - Oral Chemotherapy Example - Capecitabine â€“ includes a reference to a substance in the Ingredient element](file:///C:\temp\medicationexample0321.html)
* [Generic Formulation - Azithromycin 250mg oral capsule - includes a reference to a substance in the Ingredient element](file:///C:\temp\medicationexample0320.html)

The following are examples of Medication resources where the medication is a compounded (aka extemporaneous or magistral) product

* [Compounded Preparation - KCl in D5W Admixture - includes a reference to a substance in the ingredient element](file:///C:\temp\medicationexample0317.html)
* [Compounded Preparation - TPN Solution - includes a reference to a substance in the ingredient element](file:///C:\temp\medicationexample0318.html)
* [Compounded Preparation - HC 1%, Salicylic Acid 5% in Glaxal Base - includes a reference to a substance in the ingredient element](file:///C:\temp\medicationexample0319.html)

The following is an example where the medication resource that is minimally populated

* [Name Element Only populated - Amoxicillin 250mg/5ml Suspension](file:///C:\temp\medicationexample1.html)

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**Scope and Usage**

Representing medications in the majority of healthcare settings is a matter of identifying an item from a list and then conveying a reference for the item selected either into a patient related resource or to other applications. Additional information about the medication is frequently provided for human verification, but a full representation of the details of composition and efficacy of the medicine is conveyed by referring to drug dictionaries by means of the codes they define. There are some occasions where it is necessary to identify slightly more detail, such as when dispensing a package containing a particular medicine requires identification both of the medicine and the package at once. There are also some occasions (e.g. custom formulations) where the composition of a medicine must be represented. In these cases the ingredients of the medicine have to be specified together with the amount contained, though the medication resource does not provide full details.

The Medication resource allows for medications to be characterized by the form of the drug and the ingredient (or ingredients), as well as how it is packaged. The medication will include the ingredient(s) and their strength(s) and the package can include the amount (for example, number of tablets, volume, etc) that is contained in a particular container (for example, 100 capsules of Amoxicillin 500mg per bottle).

The medication resource can be used to describe a compounded (aka extemporaneous or magistral) product that is manufactured by the pharmacy at the time of dispensing. In this case there will be multiple ingredients which are typically base chemicals (for example, hydrocortisone powder) and there may be other ingredients that are manufacutured products (for example, Glaxal Base).

If medication includes a package, further details about the composition can be provided. A package has a container (vacuum packed box, jar, etc.) and a list of the products or other packages that are in the package.

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**Best practices for using 'Medication'**

Medication does not have a status. Pharmacy is evaluating formulary use cases. Feedback is encouraged to the Pharmacy working group committee.

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The following are examples of MedicationAdministration resources:

INJECTABLE DOSAGE FORMS

The following examples of MedicationAdministration resources for Injectable Dosage Forms that reference a Medication Resource for a manufactured product:

* [Intravenous Antibiotic - Vancomycin](file:///C:\temp\medicationadministration0301.html)
* [Intravenous Antibiotic with a Dosage Rate - Piperacillin](file:///C:\temp\medicationadministration0303.html)
* [Intravenous Chemotherapy (Inpatient order) - Alemtuzumab - completed](file:///C:\temp\medicationadministration0304.html)
* [Intravenous Chemotherapy (Inpatient order) - Brentuximab Vedotin](file:///C:\temp\medicationadministration0305.html)
* [Example of an IV administration not given with a note - Alemtuzumab](file:///C:\temp\medicationadministrationexample3.html)

The following examples of MedicationAdministration resources for Injectable Dosage Forms that reference a Medication Resource for a generic formulation:

* [Oral Antibiotic - Azithromycin](file:///C:\temp\medicationadministration0306.html)
* [Lorazepam with a Device](file:///C:\temp\medicationadministration0307.html)

The following examples of MedicationDispense resources for Injectable Dosage Forms that include a Medication Code:

* [Subcutaneous Injection - Insulin - Lantus](file:///C:\temp\medicationadministration0308.html)

The following examples of MedicationDispense resources for Injectable Dosage Forms for Injectable Dosage Forms where the medication is a compounded (aka extemporaneous or magistral) product:

* [Intravenous Admixture - Potassium Chloride in D5W](file:///C:\temp\medicationadministration0302.html)
* [TPN Solution with a Device](file:///C:\temp\medicationadministration0309.html)

ORAL DOSAGE FORMS

The following examples are MedicationDispense resources for Oral Dosage Forms that reference Medication Resources for manufactured products:

* [Oral Chemotherapy - Myleran](file:///C:\temp\medicationadministration0310.html)
* [Dosage with a Pre-Condition - Alprazolam](file:///C:\temp\medicationadministration0311.html)

MISCELLANEOUS DOSAGE FORMS

The following examples of MedicationDispense resources including miscellaneous dosage forms:

* [Medication Code - Patch - Fentanyl](file:///C:\temp\medicationadministration0312.html)
* [Medication Code - Rectal Suppository - Acetaminophen](file:///C:\temp\medicationadministration0313.html)

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**Scope and Usage**

This resource covers the administration of all medications and vaccines. Please refer to the [Immunization](file:///C:\temp\immunization.html) Resource/Profile for the treatment of vaccines. It will principally be used within care settings (including inpatient) to record the capture of medication administrations, including self-administrations of oral medications, injections, intra-venous adjustments, etc. It can also be used in out-patient settings to record allergy shots and other non-immunization administrations. In some cases it might be used for home-health reporting, such as recording self-administered or even device-administered insulin.

MedicationAdministration is an event resource from a FHIR workflow perspective - see [Workflow Event](file:///C:\temp\workflow.html#event)

**Boundaries and Relationships**

**The Medication domain includes a number of related resources**

|  |  |
| --- | --- |
| [MedicationRequest](file:///C:\temp\medicationrequest.html) | An order for both supply of the medication and the instructions for administration of the medicine to a patient. |
| [MedicationDispense](file:///C:\temp\medicationdispense.html) | Provision of a supply of a medication with the intention that it is subsequently consumed by a patient (usually in response to a prescription). |
| [MedicationAdministration](file:///C:\temp\medicationadministration.html) | When a patient actually consumes a medicine, or it is otherwise administered to them |
| [MedicationStatement](file:///C:\temp\medicationstatement.html) | This is a record of a medication being taken by a patient or that a medication has been given to a patient, where the record is the result of a report from the patient or another clinician. A medication statement is not a part of the prescribe->dispense->administer sequence, but is a report that such a sequence (or at least a part of it) did take place, resulting in a belief that the patient has received a particular medication. |

**MedicationAdministration** is intended for tracking the administration of non-vaccine medications. Administration of vaccines is intended to be handled using the [Immunization](file:///C:\temp\immunization.html) resource. Some systems treat immunizations in the same way as any other medication administration. Such systems SHOULD use an immunization resource to represent these. If systems need to use a **MedicationAdministration** resource to capture vaccinations for workflow or other reasons, they SHOULD also create and expose an equivalent [Immunization](file:///C:\temp\immunization.html) instance.

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**Known Issues**

|  |  |
| --- | --- |
| **Issue** | **Comments** |
| Medication Resource | A medication will typically be referred to by means of a code drawn from a suitable medication terminology. However, on occasion a product will be required for which the "recipe" must be specified. This implies a requirement to deal with a choice of either a code or a much more complete resource. Currently that resource has not been created. |
| Contrast Media | Is this resource adequate for administering contrast media to a patient? |
| Author (accountability) | Authorship (and any other accountability) is assumed to be dealt with by the standard FHIR methods. |

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ORAL DOSAGE FORMS

The following examples are MedicationDispense resources for Oral Dosage Forms that reference Medication Resources for a manufactured product:

* [Dispense for Oral Chemotherapy - Capecitabine (RxNorm code)](file:///C:\temp\medicationdispenseexample8.html)
* [Dispense for Oxycodone (RxNorm code) - PRN dose with dose range, coded additional instructions and PRN coded pre-condition](file:///C:\temp\medicationdispense0303.html)
* [Dispense for Prednisone (RxNorm code) Tapering Dose - entered-in-error with multiple Dosage lines that include coded additionalInstructions and multiple EventHistory elements](file:///C:\temp\medicationdispense0305.html)
* [Dispense for Percocet (NDC Code) - in-progress with additionalInstructions, and as needed dosage with condition](file:///C:\temp\medicationdispense0310.html)
* [Dispense for Over the Counter medication - Tylenol PM (NDC code) - on hold with as needed dosage with a condition, a dose Range and an Event History](file:///C:\temp\medicationdispense0312.html)
* [Dispense for Alprazolam (Rx Norm code) - in progress](file:///C:\temp\medicationdispense0315.html)
* [Dispense for Azithromycin (NDC code) - completed with multiple dosage lines](file:///C:\temp\medicationdispense0319.html)
* [Dispense for Warfarin 5mg (NDC Code) where the product is dispensed as multiple strengths based on prescribe dosage](file:///C:\temp\medicationdispense0330.html)
* [Dispense for Warfarin 2mg (NDC Code) where the product is dispensed as multiple strengths based on prescribe dosage](file:///C:\temp\medicationdispense0331.html)

The following examples are MedicationDispenses resources for Oral Dosage Forms that include a Medication Code

* [Dispense for Levothyroxine (NDC code) in-progress with authorizing prescription](file:///C:\temp\medicationdispense0318.html)
* [Dispense for Azithromycin (RxNorm Code) - in-progress with coded additionalInstructions](file:///C:\temp\medicationdispense0326.html)
* [Dispense for Dilantin Oral Suspension (NDC code) - completed](file:///C:\temp\medicationdispense0322.html)
* [Dispense for Busulfan (Myleran) - completed](file:///C:\temp\medicationdispense0307.html)
* [Dispense for Vicodin - in progress - PRN with pre-condition](file:///C:\temp\medicationdispense0321.html)

INJECTABLE DOSAGE FORMS

The following examples of MedicationDispense resources for Injectable Dosage Forms that reference a Medication Resource for a manufactured product:

* [Dispense for IV Antibiotic - in progress - Vancomycin IV (NDC Code) - in-progress](file:///C:\temp\medicationdispense0301.html)
* [Dispense for Subcutaneous injection with multiple dosage lines - Insulin - Novolog (NDC Code) - active - includes Destination, Receiver, note. Dosage includes additionalInstructions as text](file:///C:\temp\medicationdispense0302.html)
* [Dispense for Intravenous Antibiotic with a Dosage Rate - Piperacillin (NDC code) - completed with a coded site and route of administration and a rate expressed as a ratio](file:///C:\temp\medicationdispense0304.html)
* [Dispense for Intravenous Chemotherapy (inpatient order) - Alemtuzumab (RxNorm Code) - completed with multiple dosageInstruction lines](file:///C:\temp\medicationdispense0306.html)
* [Dispense for Lorazepam (Rx norm code) - completed with rate range](file:///C:\temp\medicationdispense0314.html)
* [ispense for Brentuximab Vedotin (NDC code) - IV Chemo - stopped](file:///C:\temp\medicationdispense0317.html)

The following examples of MedicationDispense resources for Injectable Dosage Forms that include a Medication Code:

* [Dispense for Insulin (Lantus) (NDC code) - in-progress with SC dosage](file:///C:\temp\medicationdispense0316.html)

The following examples of MedicationDispense resources for Injectable Dosage Forms for Injectable Dosage Forms where the medication is a compounded (aka extemporaneous or magistral) product:

* [Dispense for Potassium Chloride Admixture - stopped - with eventHistory and rate range for dosage](file:///C:\temp\medicationdispense0313.xml)
* [Dispense for a TPN solution - completed](file:///C:\temp\medicationdispense0320.xml)

MISCELLAENOUS DOSAGE FORMS

The following examples of MedicationDispense resources including miscellaneous dosage forms:

* [Dispense for Timoptic Opthalmic Drops - (NDC code) - completed](file:///C:\temp\medicationdispense0308.html)
* [Dispense for Nystatin drops (Snomed Code) - entered-in-error](file:///C:\temp\medicationdispense0309.html)
* [Dispense for Proventil (RxNorm Code) - completed - with additionalInstructions as text](file:///C:\temp\medicationdispense0327.html)
* [Dispense for Nystatin Topical Ointment (RxNorm code) - completed](file:///C:\temp\medicationdispense0324.html)
* [Dispense for Nasonex Inhaler (RxNorm Code) - in progress with additionalInstructions as text](file:///C:\temp\medicationdispense0328.html)
* [Dispense for Compounded ointment (HC 1%, SA 5% in White Petrolatum) - completed with additionalInstructions as text and a coded site in dosageInstructions](file:///C:\temp\medicationdispense0329.html)
* [Dispense for Fentanyl Patch (NDC code) - in progress](file:///C:\temp\medicationdispense0325.html)
* [Dispense for Paracetamol Suppositories - completed](file:///C:\temp\medicationdispense0311.html)

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**Scope and Usage**

This resource covers the supply of medications to a patient. Examples include dispensing and pick-up from an out-patient or community pharmacy, dispensing patient-specific medications from in-patient pharmacy to ward, as well as issuing a single dose from ward stock to a patient for consumption. The medication dispense is the result of a pharmacy system responding to a medication order.

MedicationDispense is an event resource from a FHIR workflow perspective - see [Workflow Event](file:///C:\temp\workflow.html#event)

**Boundaries and Relationships**

**The Medication domain includes a number of related resources**

|  |  |
| --- | --- |
| [MedicationRequest](file:///C:\temp\medicationrequest.html) | An order for both supply of the medication and the instructions for administration of the medicine to a patient. |
| [MedicationDispense](file:///C:\temp\medicationdispense.html) | Provision of a supply of a medication with the intention that it is subsequently consumed by a patient (usually in response to a prescription). |
| [MedicationAdministration](file:///C:\temp\medicationadministration.html) | When a patient actually consumes a medicine, or it is otherwise administered to them |
| [MedicationStatement](file:///C:\temp\medicationstatement.html) | This is a record of a medication being taken by a patient or that a medication has been given to a patient, where the record is the result of a report from the patient or another clinician. A medication statement is not a part of the prescribe->dispense->administer sequence, but is a report that such a sequence (or at least a part of it) did take place, resulting in a belief that the patient has received a particular medication. |

This resource does not deal with the supply or transfer of non-medication related items to a patient.

**Background and Context**

The supply and the associated administration instructions may not exactly follow the original order (prescription), either because some details were left for completion at this point in the process or because the dispenser exercised their clinical judgment to make some appropriate modification.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\medicationrequest\medicationrequest-examples-header.xml**

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ORAL DOSAGE FORMS

The following examples are MedicationRequest resources for Oral Dosage Forms that reference Medication Resources for generic formulations:

* [Active Order with link to encounter, reasonCode, note multiple dosage lines, dispenseRequest and substitution - Azithromycin](file:///C:\temp\medicationrequest0302.html)
* [Order with as needed (PRN) dosage with pre-condition - Oxycodone - active with reasonCode, note, dispenseRequest and substitution](file:///C:\temp\medicationrequest0301.html)
* [Order for Tapering Dose - Prednisone - active with note and multiple DosageInstructions with boundsPeriod](file:///C:\temp\medicationrequest0303.html)
* [Order for Oral Drops - Nystatin Suspension - completed - with Dispense Request](file:///C:\temp\medicationrequest0304.html)
* [Order with Dosage with a Pre-Condition - Alprazolam - dosageInstructions includes boundsPeriod with periodMax and asNeededCodeableConcept](file:///C:\temp\medicationrequest0305.html)
* [Order for a Dosage that needs to be dispensed as different strength tablets - Warfarin - active](file:///C:\temp\medicationrequest0331.html)

The following examples are MedicationRequest resources for Oral Dosage Forms that reference Medication Resources for manufactured products:

* [Oral Chemotherapy Order - Myleran - completed - with reasonCode](file:///C:\temp\medicationrequest0306.html)
* [Order with as needed (PRN) dosage - Percocet - completed with link to encounter, dispenseRequest and substitution](file:///C:\temp\medicationrequest0307.html)
* [Order for as needed (PRN) dosage - Vicodin - completed with dosageInstruction with additionalInstruction (coded) and as needed with reason, dispenseRequest and substitution](file:///C:\temp\medicationrequest0308.html)
* [Oral Chemotherapy Order - Capecitabine - active medication with dosing by Body Surface Area (BSA) (mg/m2)](file:///C:\temp\medicationrequest0309.html)
* [Order for Over the Counter Medication - Tylenol PM - with dosage range as needed with pre-condition for use](file:///C:\temp\medicationrequest0310.html)
* [Order for a medication that includes the dosage of a prescription in text](file:///C:\temp\medicationrequestexample2.html)
* [Fully populated example of a MedicationRequest - Chlorthalidone - active - with link to encounter, reasonReference, note, dispenseRequest, substitution and eventHistory](file:///C:\temp\medicationrequestexample1.html)

The following examples are MedicationRequest resources for Oral Dosage Forms that include a Medication Code

* [Liquid Medication - Phenytoin with link to prior prescription](file:///C:\temp\medicationrequest0312.html)
* [Order with a single dosage line - Azithromycin - completed - with link to prior prescription and reason code](file:///C:\temp\medicationrequest0313.html)
* [Order - Levothyroxine - completed with reasonCode, dosageInstructions and dispenseRequest](file:///C:\temp\medicationrequest0314.html)

INJECTABLE DOSAGE FORMS

The following examples of MedicationRequest resources for Injectable Dosage Forms that reference a Medication Resource for a generic formulation

* [Order for an injectable medication - Lorazepam - active - with link to encounter, reasonCode and dosageInstruction](file:///C:\temp\medicationrequest0315.html)

The following examples of MedicationRequest resources for Injectable Dosage Forms that reference a Medication Resource for a manufactured product:

* [Order for Intravenous Chemotherapy (inpatient order) - Brentuximab Vedotin - completed](file:///C:\temp\medicationrequest0316.html)
* [Order for Intravenous Chemotherapy (inpatient order) - Alemtuzumab - completed with multiple dosageInstruction lines](file:///C:\temp\medicationrequest0317.html)
* [Order for Intravenous Antibiotic - Vancomycin - active - with link to encounter, reasonCode, and note](file:///C:\temp\medicationrequest0318.html)
* [Order for Intravenous Antibiotic with a Dosage Rate - Piperacillin - completed with reason code](file:///C:\temp\medicationrequest0319.html)
* [Order for Subcutaneous injection with multiple dosage lines - Insulin - Novolog - active - includes reasonCode and note. Dosage includes additionalInstructions as text](file:///C:\temp\medicationrequest0321.html)

The following examples of MedicationRequest resources for Injectable Dosage Forms that include a Medication Code:

* [Order for Subcutaneous injection - Insulin - Lantus - completed, with reason code and dispense request](file:///C:\temp\medicationrequest0320.html)

The following examples of MedicationRequest resources for Injectable Dosage Forms for Injectable Dosage Forms where the medication is a compounded (aka extemporaneous or magistral) product:

* [Order for Intravenous Admixture - Potassium Chloride in D5W - completed with reason code](file:///C:\temp\medicationrequest0322.html)
* [Order for TPN Solution - completed](file:///C:\temp\medicationrequest0323.html)

MISCELLAENOUS DOSAGE FORMS

The following examples of MedicationRequest resources including miscellaneous dosage forms:

* [Order using Medication Code for Rectal Suppository - Acetaminophen - completed with reasonCode, dispenseRequest and substitution](file:///C:\temp\medicationrequest0324.html)
* [Order using Medication Code for Topical Ointment - Nystatin - on hold and with dispense request](file:///C:\temp\medicationrequest0325.html)
* [Order using Medication Code for Inhaler - Proventil - on hold with dispenseRequest and substitution](file:///C:\temp\medicationrequest0326.html)
* [Order using Medication Code for Patch - Fentanyl - active, with dispense request](file:///C:\temp\medicationrequest0327.html)
* [Medication Resource Reference - Nasal Spray - Nasonex](file:///C:\temp\medicationrequest0328.html)
* [Order referencing Medication Resource for Compounded Product - HC 1%, Salicylic Acid 5% in Glaxal Base - on hold with dispenseRequest](file:///C:\temp\medicationrequest0329.html)
* [Order referencing Medication Resource for Eye Drops - Timoptic - active - with link to encounter, dispenseRequest and substitution flag](file:///C:\temp\medicationrequest0330.html)

MISCELLAENOUS DOSAGE INSTRUCTIONS

The following examples of MedicationRequest resources including miscellaneous dosage instructions:

* [Order that includes a dosage instruction for a medication that is intended to be given once only as single dose](file:///C:\temp\medicationrequest0332.html)
* [Order for a medication that is intended to be given in the morning](file:///C:\temp\medicationrequest0333.html)
* [Order that includes a dosage instruction for a medication that is intended to be given once only as single dose](file:///C:\temp\medicationrequest0334.html)
* [Order that includes a dosage instruction for a medication that is intended to be given once only as single dose](file:///C:\temp\medicationrequest0335.html)

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**Scope and Usage**

This resource covers all orders for medications for a patient. This includes in-patient medication orders as well as community orders (whether filled by the prescriber or by a pharmacy). It also includes orders for over-the-counter medications (e.g. Aspirin), total parenteral nutrition and diet/ vitamin supplements. It may be used to support the order of medication-related devices. It is not intended for use in prescribing particular diets, or for ordering non-medication-related items (eye-glasses, supplies, etc.).

The MedicationRequest resource is a "request" resource from a FHIR workflow perspective - see [Workflow Request.](file:///C:\temp\workflow.html#request)

The MedicationRequest resource allows requesting only a single medication. If a workflow requires requesting multiple items simultaneously, this is done using multiple instances of this resource. These instances can be linked in different ways, depending on the needs of the workflow. For guidance, refer to [the Request pattern](file:///C:\temp\request.html#compound)

**Boundaries and Relationships**

The MedicationRequest resource is used to request or order medication for a subject. When requesting supplies or devices when there is a patient focus or instructions regarding their use, [SupplyRequest](file:///C:\temp\supplyrequest.html) or [DeviceRequest](file:///C:\temp\devicerequest.html)DeviceRequest should be used instead

**The Medication domain includes a number of related resources**

|  |  |
| --- | --- |
| MedicationRequest | An order for both supply of the medication and the instructions for administration of the medicine to a patient. |
| [MedicationDispense](file:///C:\temp\medicationdispense.html) | Provision of a supply of a medication with the intention that it is subsequently consumed by a patient (usually in response to a prescription). |
| [MedicationAdministration](file:///C:\temp\medicationadministration.html) | When a patient actually consumes a medicine, or it is otherwise administered to them |
| [MedicationStatement](file:///C:\temp\medicationstatement.html) | This is a record of medication being taken by a patient, or that the medication has been given to a patient where the record is the result of a report from the patient, or another clinician. A medication statement is not a part of the prescribe->dispense->administer sequence but is a report that such a sequence (or at least a part of it) did take place resulting in a belief that the patient has received a particular medication. |

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\medicationstatement\medicationstatement-examples-header.xml**

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The following are examples of Medication Statement resources:

* [Patient reports they are taking Tylenol PM and has the bottle](file:///C:\temp\medicationstatementexample1.html)
* [Patient reports they are not taking Tylenol PM](file:///C:\temp\medicationstatementexample2.html)
* [Patient reports they took Amoxycillin in the past but are not taking it now](file:///C:\temp\medicationstatementexample4.html)
* [Patient reports they previous said they took Amoxycillin but really didnâ€™t](file:///C:\temp\medicationstatementexample5.html)
* [Care Giver reports that Patient took Amoxycillin](file:///C:\temp\medicationstatementexample6.html)
* [Patient reports that they intend to use Mometasone in the future](file:///C:\temp\medicationstatementexample7.html)
* [Patient reports they are taking the â€œlittle pink pill for water retention](file:///C:\temp\medicationstatementexample3.html)

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**Scope and Usage**

Common usage includes:

* the recording of non-prescription and/or recreational drugs
* the recording of an intake medication list upon admission to hospital
* the summarization of a patient's "active medications" in a patient profile

A MedicationStatement may be used to record substance abuse or the use of other agents such as tobacco or alcohol. This would typically be done if these substances are intended to be inluded in clinical decision support checking (for example, interaction checking) and as part of an active medication list. If the intent is to populate social history and/or to include additional information (for example, desire to quit, amount per day, negative health effects), then it is better to record as an Observation that could then be used to populate Social History.

This resource does not produce a medication list, but it does produce individual medication statements that may be used in the List resource to construct various types of medication lists. Note that other medication lists can also be constructed from the other Pharmacy resources (e.g., MedicationRequest, MedicationAdministration).

A medication statement is not a part of the prescribe -> dispense -> administer sequence, but is a report by a patient, significant other or a clinician that one or more of the prescribe, dispense or administer actions has occurred, resulting is a belief that the patient is, has, or will be using a particular medication.

MedicationStatement is an event resource from a FHIR workflow perspective - see [Workflow Event](file:///C:\temp\workflow.html#event)

**Boundaries and Relationships**

The MedicationStatement resource is used to record a medications or substances that the patient reports as being taken, not taking, have taken in the past or may take in the future. It can also be used to record medication use that is derived from other records such as a MedicationRequest. The statement is not used to request or order a medication, supply or device. When requesting medicaation, supplies or devices when there is a patient focus or instructions regarding their use, a [MedicationRequest](file:///C:\temp\medicationrequest.html), [SupplyRequest](file:///C:\temp\supplyrequest.html) or [DeviceRequest](file:///C:\temp\devicerequest.html)DeviceRequest should be used instead

**The Medication domain includes a number of related resources**

|  |  |
| --- | --- |
| [MedicationRequest](file:///C:\temp\medicationrequest.html) | An order for both supply of the medication and the instructions for administration of the medicine to a patient. |
| [MedicationDispense](file:///C:\temp\medicationdispense.html) | Provision of a supply of a medication with the intention that it is subsequently consumed by a patient (usually in response to a prescription). |
| [MedicationAdministration](file:///C:\temp\medicationadministration.html) | When a patient actually consumes a medicine, or it is otherwise administered to them |
| MedicationStatement | This is a record of a medication being taken by a patient or that a medication has been given to a patient, where the record is the result of a report from the patient or another clinician, or derived from supporting information (for example, Claim, Observation or MedicationRequest). A medication statement is not a part of the prescribe->dispense->administer sequence, but is a report that such a sequence (or at least a part of it) did take place, resulting in a belief that the patient has received a particular medication. |

This resource is distinct from [MedicationRequest](file:///C:\temp\medicationrequest.html), [MedicationDispense](file:///C:\temp\medicationdispense.html) and [MedicationAdministration](file:///C:\temp\medicationadministration.html). Each of those resources refer to specific events - an individual order, an individual provisioning of medication or an individual dosing. MedicationStatement is a broader assertion covering a wider timespan and is independent of specific events. The existence of resource instances of any of the preceding three types may be used to infer a medication statement. However, medication statements can also be captured on the basis of other information, including an assertion by the patient or a care-giver, the results of a lab test, etc.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\medicationstatement\medicationstatement-notes.xml**

**How to determine if the patient has taken the medication**

The MedicationStatement resource includes both a status and a "Taken" code. In order to determine if the patient has actually consumed the medication systems need to use both MedicationStatement.status and MedicationStatement.taken. The following table is intended to provide guidance on the interpretation of these two attributes with respect to the MedicationStatement.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Taken** | **Information Source** | **Patient Reports** | **Active** | **Completed** | **Stopped** | **On Hold** | **Entered in Error** | **Intended** |
| Y | Patient | Patient or related person states the medication is not currently being taken | X |  |  | X |  | X |
| N | Patient | Patient or related person states the medication may be taken in the future | X |  |  | X |  | X |
| UNK | Patient | Patient or related person states they may take this medication in the future | X |  |  | X |  | X |
| NA |  |  | X | X |  | X |  |  |
| UNK |  | No assertion by patient or related person of whether the medication is being consumed | X |  |  | X |  | X |
| NA |  | Patient admitted or outpatient administration (MAR) | X | X | X | X | X | X |

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\adverseevent\adverseevent-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\adverseevent\adverseevent-introduction.xml**

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**Scope and Usage**

AdverseEvent is an event resource from a FHIR workflow perspective - see [Workflow Event](file:///C:\temp\workflow.html#event)

This resource applies to events that occur during the course of medical care or medical research which may impact an individual as the recipient of care or the participant in a research study. There are also events that occur within a care setting that may or may not impact an individual but had the potential to cause an adverse event. Health care organizations monitor and report both adverse events as well as events that had the potential to cause patient harm. Data are often aggregated for reporting purposes.

An adverse event is the result of an intervention that caused unintentional harm to a specific subject or group of subjects. Examples of adverse events include the administration of an incorrect drug or an incorrect dose of a drug causing an adverse reaction, the use of an implanted device that causes an infection, or a biologic used during a research study that causes unanticipated renal failure. These events are characterized by the need to capture cause and effect (although they may not be known at the time of the event), severity, and outcome.

The context of an adverse event is also important. A subject may have condition(s) or current treatments (medications, diet, devices) that impact their response to a newly introduced medication, device or procedure. Knowledge of these variables is essential in establishing a cause and effect relationship for an adverse event.

A potential adverse event may also be called a near miss or an error. These are also events but because they were detected did not cause harm to a subject. Examples of potential adverse events include a product problem such as a faulty pacemaker that is detected prior implantation, a doctor working simultaneously on two electronic health records realizing the order for a drug was entered on the incorrect patient and then canceling the order, or a patient with a peanut allergy notices that his hospital dinner tray includes peanuts, and he does not eat the peanuts.

**Boundaries and Relationships**

The AdverseEvent resource is designed to represent events that have a harmful impact on a subject, or had the potential to cause harm to a subject but were avoided. In the course of medical care there are many actions that may impact how a subject responds to a particular treatment impacting patient safety. Therefore the AdverseEvent resource may reference multiple other resources to represent the context or details of an adverse event including but not limited to Observation, Condition, MedicationAdminsitration, Immunization, Procedure, or ResearchStudy.

A DetectedIssue reference is also related to the context of an AdverseEvent to the extent that a known risk for a potential issue such as a drug-drug interaction is documented. If in the context of a known issue, and adverse event occurs, citing this relationship is important for preventing such an occurrence in the future.

The AdverseEvent resource should not be used when a more specific resource exists.

* The AllergyIntolerance resource is a case specific means of capturing the condition of an allergy or intolerance and the criticality (or potential for future harm) based on the response of a particular individual.
* The Clinical Reasoning module provides resources and operations to enable the representation, distribution, and evaluation of clinical knowledge artifacts such as clinical decision support rules, quality measures, order sets, and protocols. The suite of resources within the clinical reasoning module should be used to capture clinical quality measures and clinical protocols that help drive clinical best practices.
* The AdverseEvent resource is not intended to be used to capture potential subject risk in a prospective manner. A more appropriate resource for this purpose would be Risk Assessment which captures predicted outcomes for a patient or population on the basis of source information. Examples include a prognosis statement for a particular condition, risk of health outcome (heart attack, particular type of cancer) on the basis of lifestyle factors and/or family history or list of potential health risks based on a patient's genetic analysis.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\adverseevent\adverseevent-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchstudy\researchstudy-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchstudy\researchstudy-introduction.xml**

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**Scope and Usage**

This resource supports the HL7 mission to create and promote HL7 standards by developing RCRIM standards to improve or enhance information management during clinical research and regulatory evaluation of the safety, efficacy and quality of therapeutic products and procedures worldwide.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchstudy\researchstudy-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchsubject\researchsubject-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchsubject\researchsubject-introduction.xml**

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**Scope and Usage**

This resource supports the HL7 mission to create and promote HL7 standards by developing RCRIM standards to improve or enhance information management during clinical research and regulatory evaluation of the safety, efficacy and quality of therapeutic products and procedures worldwide.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\researchsubject\researchsubject-notes.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\composition\composition-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\composition\composition-introduction.xml**

**Scope and Usage**

A Composition is also the basic structure from which [FHIR Documents](file:///C:\temp\documents.html) - immutable bundles with attested narrative - are built. A single logical composition may be associated with a series of derived documents, each of which is a frozen copy of the composition.

Note: [EN 13606](http://en.wikipedia.org/wiki/EN_13606) uses the term "Composition" to refer to a single commit to an EHR system, and offers some common examples: a composition containing a consultation note, a progress note, a report or a letter, an investigation report, a prescription form or a set of bedside nursing observations. Using Composition for an attested EHR commit is a valid uses of the Composition resource, but for FHIR purposes, it would be usual to make more granular updates with individual provenance statements.

**Boundaries and Relationships**

Composition is a structure for grouping information for purposes of persistance and attestability. There are several other grouping structures in FHIR with distinct purposes:

* The [List](file:///C:\temp\list.html) resource - enumerates a flat collection of resources and provides features for managing the collection. While a particular List instance may represent a "snapshot", from a business process perspective, the notion of "list" is dynamic â€“ items are added and removed over time. The List resource references other resources. Lists may be curated and have specific business meaning.
* The [Group](file:///C:\temp\group.html) resource - defines a group of specific people, animals, devices, etc. by enumerating them, or by describing qualities that group members have. The Group resource refers to other resources, possibly implicitly. Groups are intended to be acted upon or observed as a whole (e.g., performing therapy on a group, calculating risk for a group, etc.). This resource will commonly be used for public health (e.g., describing an at-risk population), clinical trials (e.g., defining a test subject pool) and similar purposes.
* The [Bundle](file:///C:\temp\bundle.html) resource - is an infrastructure container for a group of resources. It does not have narrative and is used to group collections of resources for transmission, persistence or processing (e.g., messages, documents, transactions, query responses, etc.). The content of bundles is typically algorithmically determined for a particular exchange or persistence purpose.
* The [Composition](file:///C:\temp\composition.html) resource - defines a set of healthcare-related information that is assembled together into a single logical document that provides a single coherent statement of meaning, establishes its own context and that has clinical attestation with regard to who is making the statement. The Composition resource provides the basic structure of a FHIR [document](file:///C:\temp\documents.html). The full content of the document is expressed using a bundle containing the Composition and its entries.

The Composition resource organizes clinical and administrative content into sections, each of which contains a narrative, and references other resources for supporting data. The narrative content of the various sections in a Composition are supported by the resources referenced in the section entries. The complete set of content to make up a document includes the Composition resource together with various resources pointed to or indirectly connected to the Composition, all gathered together into a [Bundle](file:///C:\temp\bundle.html) for transport and persistence. The following list of Composition references SHALL be included in the bundle:

<%res-ref-list Composition%>

Other resources referred to by those resources may be included in the bundle at the discretion of the authoring system, or as specified by any applicable profiles.

**Background and Context**

**Composition Status Codes**

Every composition has a status element, which describes the status of the content of the composition, taken from this list of codes:

|  |  |
| --- | --- |
| **Code** | **Definition** |
| preliminary | This is a preliminary composition (also known as initial or interim). The content may be incomplete or unverified. |
| final | The composition is complete and verified by an appropriate person and no further work is planned. |
| appended | The composition has been modified subsequent to being marked and/or released as "final" and is complete and verified by an authorized person. The modifications added new information to the composition, but did not revise existing content. |
| amended | The composition content or the referenced resources have been modified subsequently to being released as "final", and the composition is complete and verified by an authorized person. |
| retracted | The composition was originally created/issued in error and this is an amendment that marks that the entire composition and any past versions or copies should not be considered as valid. |

Composition status generally only moves down through this list - it moves from preliminary to final and then it may progress to either appended or amended. Note that in many workflows, only final compositions are made available and the preliminary status is not used.

A very few compositions are created entirely in error in the workflow - usually the composition concerns the wrong patient or is written by the wrong author, and the error is only detected after the composition has been used or documents have been derived from it. To support resolution of this case, the composition is updated to be marked as "retracted" and a new derived document can be created. This means that the entire series of derived documents is now considered to be created in error and systems receiving derived documents based on retracted compositions SHOULD remove data taken from earlier documents from routine use and/or take other appropriate actions. Systems are not required to provide this workflow or support documents derived from retracted compositions, but they SHALL NOT ignore a status of retracted. Note that systems that handle compositions or derived documents and don't support the retracted status need to define some other way of handling compositions that are created in error; while this is not a common occurrence, some clinical systems have no provision for removing erroneous information from a patient's record, and there is no way for a user to know that it is not fit for use - this is not safe.

**Note for CDA aware readers**

Many users of this specification are familiar with the [Clinical Document Architecture](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) (CDA) and related specifications. CDA is a primary design input to the Composition resource (other principle inputs are other HL7 document specifications and EN13606). There are two important structural differences between CDA and the Composition resource:

* A composition is a logical construct- its identifier matches to the CDA ClinicalDocument.setId. Composition resources are wrapped into [Document](file:///C:\temp\documents.html) structures, for exchange of the whole package (the composition and its parts), and this wrapped, sealed entity is equivalent to a CDA document, where the Bundle.id is equivalent in function to ClinicalDocument.id (but it is not identical when interconverting, since it's a transform between them).
* The composition section defines a section (or sub-section) of the document, but unlike CDA, the section entries are actually references to other [resources](file:///C:\temp\resourcelist.html) that hold the supporting data content for the section. This design means that the data can be reused in many other ways.
* Unlike CDA, the context defined in the Composition (the confidentiality, subject, author, event, event period and encounter) apply to the composition and do not specifically apply to the resources referenced from the section.entry. There is no context flow model in FHIR, so each resource referenced from within a Composition expresses its own individual context. In this way, clinical content can safely be extracted from the composition.

In addition, note that both the code lists (e.g., [Composition.status](file:///C:\temp\valueset-composition-status.html)) and the Composition resource are [mapped](file:///C:\temp\composition-mappings.html) to [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) and/or CDA.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\composition\composition-measurereport-profile-introduction.xml**

**Introduction**

This project is to create a Measure Report FHIR Profile to represent aggregate measure scores and to allow for drill down into the data that is used to determine the measure scores. This specification aims to focus on the needs of the international implementer community and not focus solely on US quality reporting needs. The Measure Report FHIR Profile should be compatible with the new harmonized Health Quality Improvement specifications.

The project aims to target implementers who may not use QRDA for exchanging data on measure reports.

This profile also aims to accomplish the following:

* Explore representing measure reports using FHIR
* Represent aggregate measure scores with break downs
* Explore different levels of drill down
* Provide examples of components in this profile and QRDA
* Document improvements with QRDA
* Benefits of being able to RESTfully query measure reports using FHIR

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**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 contents of the document resource, the subject resource and the resources referred to in the Composition.section.content references. Because documents are often derived Compositions and the attestation from the composition is held to apply to the document, the method for [presenting a document](file:///C:\temp\documents.html#presentation) should be used when/if attesters review the content of the composition.
* The custodian is responsible for the maintenance of the composition and any documents derived from it. With regard to the documents, they are responsible for the policy regarding persistence of the documents. Although they need not actually retain a copy of the document, they SHOULD do so.

**STU Note:** Feedback is welcome on two issues related to Composition:

* For many compositions, the title is the same as the text or a display name of Composition.type (e.g., a "consultation" or "progress note"). Note that [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) does not make title mandatory, but there are no known cases where it is useful for title to be omitted, so it is mandatory here during the trial use period.
* A client can ask a server to generate a fully bundled document from a Composition resource using the $generate operation. This operation definition does not resolve the question how document signatures are created. This is an open issue during the period of trial use, and feedback is requested regarding this question.

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

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\documentmanifest\documentmanifest-examples-header.xml**

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**Scope and Usage**

A document manifest gathers a set of [DocumentReference](file:///C:\temp\documentreference.html) resources into a single package that may be the subject of workflow such as access control, auditing, and targeted delivery.

Typically, DocumentManifest resources are used in document indexing systems, such as [IHE XDS](http://wiki.ihe.net/index.php?title=Cross-Enterprise_Document_Sharing).

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\documentreference\documentreference-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\documentreference\documentreference-introduction.xml**

**Scope and Usage**

A DocumentReference resource is used to describe a document that is made available to a healthcare system. A document is some sequence of bytes that is identifiable, establishes its own context (e.g., what subject, author, etc. can be displayed to the user), and has defined update management. The DocumentReference resource can be used with any document format that has a recognized mime type and that conforms to this definition.

Typically, DocumentReference resources are used in document indexing systems, such as [IHE XDS](http://wiki.ihe.net/index.php?title=Cross-Enterprise_Document_Sharing), and are used to refer to:

* [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) documents in FHIR systems
* [FHIR documents](file:///C:\temp\documents.html) stored elsewhere (i.e. registry/repository following the XDS model)
* [PDF documents](http://en.wikipedia.org/wiki/Portable_Document_Format), and even digital records of faxes where sufficient information is available
* Other kinds of documents, such as records of prescriptions

**Boundaries and Relationships**

FHIR defines both a [document format](file:///C:\temp\documents.html) and this document reference. FHIR documents are for documents that are authored and assembled in FHIR. This resource is mainly intended for general references to other documents.

The document that is a target of the reference can be a reference to a FHIR document served by another server, or the target can be stored in the special [FHIR Binary Resource](file:///C:\temp\http.html#binary), or the target can be stored on some other server system. The document reference is also able to address documents that are retrieved by a service call such as an XDS.b RetrieveDocumentSet, or a DICOM exchange, or an [HL7 v2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185) message query - though the way each of these service calls works must be specified in some external standard or other documentation.

A DocumentReference describes some other document. This means that there are two sets of provenance information relevant here: the provenance of the document, and the provenance of the document reference. Sometimes, the provenance information is closely related, as when the document producer also produces the document reference, but in other workflows, the document reference is generated later by other actors. In the DocumentReference resource, the [meta](file:///C:\temp\resource.html#Meta) content refers to the provenance of the reference itself, while the content described below concerns the document it references. Like all resources, there is overlap between the information in the resource directly, and in the general [Provenance](file:///C:\temp\provenance.html) resource. This is discussed as [part of the description of the Provenance resource](file:///C:\temp\provenance.html#overlap).

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**Implementation Notes**

* The use of the .docStatus codes is discussed in the [Composition description](file:///C:\temp\composition.html#status)
* The resources maintain one way relationships that point backwards - e.g., the document that replaces one document points towards the document that it replaced. The reverse relationships can be followed by using indexes built from the resources. Typically, this is done using the search parameters described below. Given that documents may have other documents that replace or append them, clients should always check these relationships when accessing documents

**Generating a Document Reference**

A client can ask a server to generate a document reference from a document. The server reads the existing document and generates a matching DocumentReference resource, or returns one it has previously generated. Servers may be able to return or generate document references for the following types of content:

|  |  |
| --- | --- |
| **Type** | **Comments** |
| [FHIR Documents](file:///C:\temp\documents.html) | The uri refers to an existing Document |
| [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) Document | The uri is a reference to a [Binary](file:///C:\temp\binary.html) end-point that returns either a CDA document, or some kind of CDA Package that the server knows how to process (e.g., an IHE .zip) |
| Other | The server can be asked to generate a document reference for other kinds of documents. For some of these documents (e.g., PDF documents) a server could only provide a document reference if it already existed or the server had special knowledge of the document. |

The server either returns a search result containing a single document reference, or it returns an error. If the URI refers to another server, it is at the discretion of the server whether to retrieve it or return an error.

The operation is initiated by a named query, using \_query=generate on the /DocumentReference end-point:

GET [service-url]/DocumentReference/?\_query=generate&uri=:url&...

The "uri" parameter is a relative or absolute reference to one of the document types described above. Other parameters may be supplied:

|  |  |
| --- | --- |
| **Name** | **Meaning** |
| persist | Whether to store the document at the document end-point (/Document) or not, once it is generated. Value = true or false (default is for the server to decide). |

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**Scope and Usage**

The XDS profile describes in detail how the [DocumentReference](file:///C:\temp\documentreference.html) and [DocumentManifest](file:///C:\temp\documentmanifest.html) resources are used in the context of XDS. The two resources may be used as a facade to an existing XDS server, such as is used for the [IHE MHD](http://wiki.ihe.net/index.php?title=Mobile_access_to_Health_Documents_(MHD)) specification, or it can be used the other way around, where the XDS functionality is implemented using a FHIR based server as the storage mechanism.

**Background and Context**

The FHIR DocumentReference and DocumentManifest resources are based on the functionality defined by XDS, but they differ from XDS in some significant ways:

* SubmissionSet = DocumentManifest, and DocumentEntry = DocumentReference. These renamings are appropriate in the wider context of how these resources are used in FHIR.
* There is no direct association between a transaction and a DocumentManifest in FHIR, however a [transaction](file:///C:\temp\http.html#transaction) may be used to ensure consistent commits.
* Patient, Author and Authenticator are represented using standard [Patient](file:///C:\temp\patient.html) and [Practitioner](file:///C:\temp\practitioner.html) resources.
* The functionality expressed through the XDSFolder resource is implemented using the [List](file:///C:\temp\list.html) resource, or by [tags.](file:///C:\temp\resource.html#tags)
* Some XDS specific fields that are not generally applicable do not have matching elements in the DocumentReference resource, and are implemented as FHIR extensions.

**Mapping Notes**

The formal mappings are found below, but this section provides some additional description to help understand the relationships between the XDS transaction and the FHIR resources.

|  |  |
| --- | --- |
| Patient | The following attributes of patient are all found in the [Patient](file:///C:\temp\patient.html) resource:   * **patientId**: Patient.identifier. The patientId has a use of "official" * **sourcePatientId**: Patient.identifier. The sourcePatientId has a use of "usual" * **PatientInfo**: Various properties as appropriate in the Patient resource |
| Author | The following attributes of author are all found in the [Practitioner](file:///C:\temp\practitioner.html) resource:   * **authorInstitution**: Practitioner.organization (and possibly Organization.identifier and Organization.name in a target Organization resource) * **authorPerson**: Practitioner.identifier and Practitioner.name * **authorRole**: Practitioner.role * **authorSpecialty**: Practitioner.specialty * **authorTelecommunication**: Practitioner.telecom |
| LegalAuthenticator | In XDS, policy is that there is a "legal authenticator", and this is represented in the DocumentReference.authenticator element (it has a more general meaning so it's not so restrictive outside the XDS use case) |
| Identifiers | The different identifiers go in different places, depending on the nature of the identifier:   * **entryUUID**: [Logical Id](file:///C:\temp\resource.html#metadata) of the DocumentReference/DocumentManifest resource * **uniqueId**: DocumentReference.masterIdentier - the identifier of the document itself * **homeCommunityId & repositoryUniqueId**: These data items are not needed in a FHIR context because the document reference is directly available. If it's still needed for XDS service calls, use a service parameter by the name same name. Where the homeCommunityId is needed in a manifest, an [extension](file:///C:\temp\extensibility.html) is defined (http://hl7.org/fhir/StructureDefinition/xdshomeCommunityId, which contains a [uri](file:///C:\temp\datatypes.html#uri)). |
| Availability Status | Approved (available for patient care): DocumentReference/Manifest.status = current  Deprecated (obsolete): DocumentReference/Manifest.status = superseded |
| Comments | The information that currently is found in the comments slot is placed in the equivalent resource narrative (for human consumption) |
| Folders | There is no direct equivalent between to XDS folders in FHIR. Workflow associated with a document reference may be managed using [Tags](file:///C:\temp\resource.html#tags), or documents can be explicitly grouped using the [List resource](file:///C:\temp\list.html). |

**Handling Updates**

The [RESTful API](file:///C:\temp\http.html) allows updates to the DocumentReference/DocumentManifest resources that the document repository is built on.

In the context of XDS, servers SHALL ensure that the masterIdentifier element of a DocumentReference is never changed after the resource is created. When a new document is created, a new DocumentReference SHALL be created. The server SHOULD ensure that the supersedes element is correctly populated, along with the status of any existing documents that are being superseded. It MAY choose to do this by requiring the clients to perform this operation, or by simply performing the operation itself.

When used with XDS, updates to the document reference resource are only performed to correct the details associated with the document description - other identifiers, context, location, etc. The document itself, the hash value, etc., SHOULD never change. Servers MAY choose to maintain the repository of resources so that there is only one DocumentReference for each original document (unique masterIdentifiers), but doing so will require some way of resolving conflicting claims around the document metadata from different submitters.

In order to implement the XDS profile, a server SHALL keep a full version history of DocumentReference, DocumentManifest, Patient, and Practitioner resources. This allows for audit investigations, and also replication using standard pub/sub arrangements.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\documentreference\xds-notes.xml**

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\auditevent\auditevent-examples-header.xml**

ï»¿

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\auditevent\auditevent-introduction.xml**

**Scope and Usage**

The audit event is based on the IHE-ATNA Audit record definitions, originally from [RFC 3881](http://tools.ietf.org/html/rfc3881), and now managed by DICOM (see [DICOM Part 15 Annex A5](http://medical.nema.org/medical/dicom/current/output/html/part15.html#sect_A.5)).

* ASTM E2147 â€“ Setup the concept of security audit logs for healthcare including accounting of disclosures
* IETF RFC 3881 â€“ Defined the Information Model (IETF rule forced this to be informative)
* DICOM Audit Log Message â€“ Made the information model Normative, defined Vocabulary, Transport Binding, and Schema
* IHE ATNA â€“ Defines the grouping with secure transport and access controls; and defined specific audit log records for specific IHE transactions.
* NIST SP800-92 â€“ Shows how to do audit log management and reporting â€“ consistent with our model
* HL7 PASS â€“ Defined an Audit Service with responsibilities and a query interface for reporting use
* ISO 27789 â€“ Defined the subset of audit events that an EHR would need
* ISO/HL7 10781 EHR System Functional Model Release 2
* ISO 21089 Trusted End-to-End Information Flows

This resource is managed collaboratively between HL7, DICOM, and IHE.

The primary purpose of this resource is the maintenance of security audit log information. However, it can also be used for any audit logging needs and simple event-based notification.

**Background and Context**

All actors; such as applications, processes, and services; involved in an auditable event should record an AuditEvent. This will likely result in multiple AuditEvent entries that show whether privacy and security safeguards, such as access control, are the properly functioning across an enterprise's system-of-systems. Thus it is typical to get an auditable event recorded by both the application in a workflow process, and the servers that support them. For this reason, duplicate entries are expected, which is helpful because it may aid in the detecting of, for example, fewer than expected actors being recorded in a multi-actor process or attributes related to those records being in conflict, which is an indication of a security problem. There may be non-participating actors that also detect a security relevant event and thus would record an AuditEvent, such as a trusted intermediary.

Security relevant events are not limited to communications or RESTful events. They include software startup and shutdown; user login and logout; access control decisions; configuration events; software installation; policy rules changes; and manipulation of data that exposes the data to users. See Audit Event Sub-Type vocabulary for guidance on some security relevant events.

The content of an AuditEvent is intended for use by Security System Administrators, Security and Privacy Information Managers, and Records Management personnel. This content is not intended to be accessible or used directly by other healthcare users, such as Providers or Patients, although reports generated from the raw data would be useful. An example is a Patient centric Accounting of Disclosures or an Access Report. Servers that provide support for Audit Event resources would not generally accept update or delete operations on the resources, as this would compromise the integrity of the audit record. Access of the AuditEvent would typically be limited to e.g., security, privacy, or other system administration purposes.

Relationship of AuditEvent and Provenance resources are often (though not exclusively) created by the application responding to the create/read/query/update/delete/execute etc. event. A [Provenance resource](file:///C:\temp\provenance.html) resource contains overlapping information, but is a record-keeping assertion that gathers information about the context in which the information in a resource "came to be" in its current state, e.g., whether it was created de novo or obtained from another entity in whole, part, or by transformation. Provenance resources are prepared by the application that initiates the create/update of the resource, and may be persisted with the AuditEvent target resource.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\auditevent\auditevent-notes.xml**

**Using Coded Values**

The AuditEvent resource and the ATNA Audit record are used in many contexts throughout healthcare. The coded values defined in the "extensible" bindings above are those widely used and/or defined by DICOM, IHE or ISO, who all defined these codes to meet very specific use cases. These codes should be used when they are suitable, or other codes can be defined.

Note when using codes from a vocabulary, the displayName can be left off so as to keep the AuditEvent size small and minimize impact of a large audit log of similar entries.

The set of codes defined for this resource is expected to grow over time, and additional codes may be proposed / requested using the community input link above.

**Event codes for Common Scenarios**

This table summarizes common event scenarios, and the codes that should be used for each case.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Scenario** | **type** | **subtype** | **action** | Other |
| User Login ([example](file:///C:\temp\auditevent-examples.html)) | [110114](file:///C:\temp\codesystem-dicom-dcim.html#110114) User Authentication | [110122](file:///C:\temp\codesystem-dicom-dcim.html#110122) User Authentication | [E](file:///C:\temp\valueset-audit-event-action.html) Execute | One participant which contains the details of the logged in user. |
| User Logout ([example](file:///C:\temp\auditevent-examples.html)) | [110114](file:///C:\temp\codesystem-dicom-dcim.html#110114) User Authentication | [110123](file:///C:\temp\codesystem-dicom-dcim.html#110123) User Logout | [E](file:///C:\temp\valueset-audit-event-action.html) Execute | One participant which contains the details of the logged out user. |
| REST operation logged on server ([example](file:///C:\temp\auditevent-examples.html)) | [rest](file:///C:\temp\valueset-audit-event-type.html) RESTful Operation | [[code]](file:///C:\temp\valueset-type-restful-interaction.html) defined for operation | [\*](file:///C:\temp\valueset-audit-event-action.html) (see below) | Participant for logged in user, if available, and one object with a reference, if at least the type is known as part of the operation. Reference.url should be provided to the granularity known. |
| Search operation logged on server ([example](file:///C:\temp\audit-event-example-search.html)) | [rest](file:///C:\temp\valueset-audit-event-type.html) RESTful Operation | [[code]](file:///C:\temp\valueset-type-restful-interaction.html) defined for operation | [E](file:///C:\temp\valueset-audit-event-action.html) Execute | Participant for logged in user, if available, and one object with a query element. |

Audit Event Actions for RESTful operations:

|  |  |
| --- | --- |
| **Operation** | **Action** |
| create | C |
| read, vread, history-instance, history-type, history-system | R |
| update | U |
| delete | D |
| transaction, operation, conformance, validate, search, search-type, search-system | E |

**PurposeOfEvent and PurposeOfUse**

The audit event provides the element purposeOfEvent to convey the purpose of the event and purposeOfUse to convey the reason that a particular actor (machine, person, software) was involved in the event.

PurposeOfEvent is an element at the level of AuditEvent and can convey the purpose of the activity that resulted in the event. This will occur when the system that is reporting the event is be aware of the purpose of the event. A specific example would be a radiology reporting system where a radiologist has created and is sending a finished report. This system likely knows the purpose, e.g., â€œtreatmentâ€. It is multi-valued because the one event may be related to multiple purposes.

It is also commonplace that the reporting system does not have information about the purpose of the event. In these cases, the event report would not have a purposeOfEvent.

It is also likely that the same event will be reported from different perspectives, e.g., by both the sender and recipient of a communication. These two different perspectives can have different knowledge regarding the purposeOfEvent.

PurposeOfUse is an element at the level of agent within AuditEvent. This describes the reason that this particular person, machine, or software is participating in the activity that resulted in the event. For example, an individual person participating in the event may assert a purpose of use from their perspective. It is also possible that they are participating for multiple reasons, and report multiple purposeOfUse.

The reporting system might not have knowledge regarding why a particular machine or person was involved, and would omit this element in those cases.

When the same event is reported from multiple perspectives, the reports can have different knowledge regarding the purpose.

**C:\Users\lloyd\Documents\SVN\FHIR\build\source\provenance\provenance-examples-header.xml**

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\provenance\provenance-introduction.xml**

**Scope and Usage**

The Provenance resource tracks information about the activity that created a version of a resource, including the entities, and agents involved in producing a resource. This information can be used to form assessments about its quality, reliability or trustworthiness, or to provide pointers for where to go to further investigate the origins of the resource and the information in it.

[Provenance resources](file:///C:\temp\provenance.html) are a record-keeping assertion that gathers information about the context in which the information in a resource was obtained. Provenance resources are prepared by the application that initiates the create/update etc. of the resource. An [AuditEvent](file:///C:\temp\auditevent.html) resource contains overlapping information, but is created as events occur, to track and audit the events. AuditEvent resources are often (though not exclusively) created by the application responding to the read/query/create/update, etc., event.

**Boundaries and Relationships**

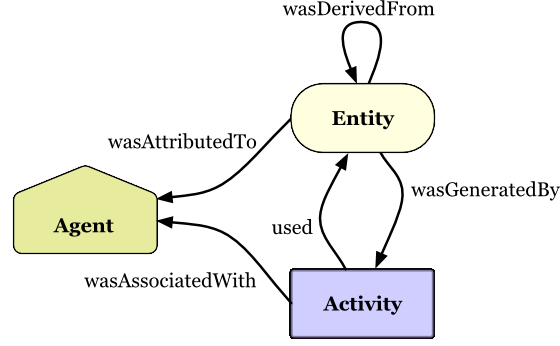
Many other FHIR resources contain some elements that represent information about how the resource was obtained, and therefore they overlap with the functionality of the Provenance resource. These properties in other resources should always be used in preference to the Provenance resource, and the Provenance resource should be used where additional information is required, though overlap can occur.

The relationship between a resource and it's provenance is established by a reference from the provenance resource to it's target. In this way, provenance may be provided about any resource or version, including past versions. There may be multiple provenance records for a given resource or version of a resource.

**Background and Context**

The Provenance resource is based on the [W3C Provenance specification](http://www.w3.org/TR/2013/NOTE-prov-overview-20130430/), and mappings are provided. The Provenance resource is tailored to fit the FHIR use-cases for provenance more directly. In terms of [W3C Provenance](http://www.w3.org/TR/prov-dm/) the FHIR [Provenance resources](file:///C:\temp\provenance.html) covers "Generation" of "Entity" with respect to FHIR defined resources for creation or updating; whereas [AuditEvent](file:///C:\temp\auditevent.html) covers "Usage" of "Entity" and all other "Activity" as defined in W3C Provenance.

The W3C Provenance Specification has the following fundamental model:



Where:

* Target - An entity that is a FHIR resource instance that is created, updated or deleted.
* Entity - An entity is a physical, digital, conceptual or other kind of thing with some fixed aspects; entities may be real or imaginary.
* Agent - An agent is something that bears some form of responsibility for an activity taking place, for the existence of an entity, or for another agent's activity.
* Activity - An activity is something that occurs over a period of time and acts upon or with entities; it may include consuming, processing, transforming, modifying, relocating, using, or generating entities.

The Provenance resource actually corresponds to a single activity that identifies a set of resources (*target*) generated by the activity. The activity also references other entities (*entity*) that were used and the agents (*agent*) that were associated with the activity. To record multiple activities that resulted in one (*target*), record each (*activity*) in independent Provenance records all pointing at that (*target*).

The Provenance resource depends upon having References to all of the resources, entities, and agents involved in the activity. These References need not be resolvable. The references must provide a unique and ambiguous identification. If a resource, entity, or agent can have different versions that must be identified, then the Reference must have versioning information included.

Versioning and unique identification are not mandated for all systems that provide Resources, entities, and agents. But, inclusion of Provenance requirements may introduce requirements for versioning and unique identification on those systems

The Provenance resource is based on leveraging the W3C Provenance specification to represent HL7 support of provenance throughout its standards and explicitly modeled as functional capabilities in ISO/HL7 10781 EHR System Functional Model Release 2 and ISO 21089 Trusted End-to-End Information Flows; and mappings are provided. The Provenance resource is tailored to fit the FHIR use-cases for provenance more directly. In terms of W3C Provenance the FHIR Provenance resources covers "Generation" of "Entity" with respect to FHIR defined resources for creation or updating; whereas AuditEvent covers "Usage" of "Entity" and all other "Activity" as defined in W3C Provenance.

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**Using the Provenance Resource**

The Provenance resource identifies information about another resource (the *reference* element). The Provenance resource may be used in several different ways:

* As part of a [document bundle](file:///C:\temp\documents.html) where it identifies the provenance of part or all of the document
* On a [RESTful system](file:///C:\temp\http.html) where it keeps track of provenance information relating to resources

When used in a document bundle, the *references* are often not explicitly versioned, but they always implicitly pertain to the version of the resource found in the document. On a RESTful system, the target resource reference should be version specific, but this requires special care: For new resources that need to have a corresponding Provenance resource, the version-specific reference is often not knowable until after the target resource has been updated. This can create an integrity problem for the system - what if the Provenance resource cannot be created after the target resource has been updated? To avoid any such integrity problems, the target resource and the Provenance resources should be submitted as a pair using a [transaction](file:///C:\temp\http.html#transaction).

**Digital Signatures**

The Provenance resource includes a *signature* element (digital signature) which can be used for standards based integrity verification and non-repudiation purposes. The *Signature* datatype provides details on use of the *signature* element. The Signature.type coded value of "Source" should be used when the signature is for simply proving that the resource content is the same as it was when the resource was updated or created.

**Party References**

Because the Provenance resource often refers to parties that are not represented as FHIR resources, *agent* and *entity* references are allowed to be either references to other resources, or they can refer to other entities that are not FHIR resources.

For Provenance.agent, the *actor* element is used to reference an existing resource. To reference an entity that is not a FHIR resource, the *userId* element is used.

A version specific reference to a FHIR resource on the same server:

<agent>

<actor>

<reference value="Patient/34/\_history/3"/>

</actor>

</agent>

A reference to a user (a person) not represented by a FHIR resource:

<agent>

<userId>

<value value="http://acme.com/users/34"/>

</userId>

</agent>

For Provenance.entity, the code in the *.type* element is used to differentiate between the two cases: if the code is in the system "http://hl7.org/fhir/resource-types", then the reference is to a resource, and the element *reference* functions exactly the same as in a [resource reference](file:///C:\temp\references.html#references).

A version specific reference to a FHIR resource on the same server:

<entity>

<type>

<system value="http://hl7.org/fhir/resource-types"/>

<code value="Patient"/>

</type>

<reference value="Patient/34/\_history/3"/>

</entity>

In effect, this is the same pattern as a standard resource reference, but the type becomes extensible to allow referencing other kinds of resources.

A reference to a entity (a person) not represented by a FHIR resource:

<entity>

<type>

<system value="http://hl7.org/fhir/provenance-participant-type"/>

<code value="person"/>

</type>

<reference value="http://acme.com/users/34"/>

</entity>

One subtle issue with the use of the Provenance resource is to differentiate between whether the reference is to the resource itself, or whether the the reference is to the real world thing that the resource represents, e.g. was it the person involved in the activity, or the record of the person. For agents, it should be understood that the reference is to the real world thing that the resource represents.

**Provenance of Removal**

A Provenance record can be recorded to indicate who Deleted a Resource. If versioning is supported, the version that was deleted is referenced in Provenance.target; if versioning is not supported then Provenance.target contains the non-version reference. Provenance.entity is not used unless there is a business requirement to do so.

**Use of Provenance to record Import and Transform**

Provenance can be used to record activities of an automaton that transforms input. Such as middleware that extracts information from a HL7 v2 message and creates FHIR resources, or middleware that extracts information from an HL7 CDA document and creates FHIR resources, etc. The Provenance in these cases is recording the activity of the middleware.

The middleware in this case would, in addtion to creating the target resources, create a Provenance resource that indicates all the target resources (using Provenance.target). The middleware is identified as one of the Provenance.agent elements, with the Provenance.agent.role of assembler.

The middleware may record the source as another Provenance.agent element.

The original content is optionally saved. This might be as a DocumentReference, or Binary. The Provenance.entity would then point at this original content.

The original source might include some form of 'provenance' to cover the history of the orignal content prior to the import transformation. This original source 'provenance' should be converted into FHIR Provenance records as appropriate.

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**C:\Users\lloyd\Documents\SVN\FHIR\build\source\codesystem\codesystem-introduction.xml**

**Scope and Usage**

The FHIR terminology specification is based on two key concepts, originally defined in [HL7 v3 Core Principles](http://www.hl7.org/documentcenter/public/standards/V3/core_principles/infrastructure/coreprinciples/v3modelcoreprinciples.html):

* **code system** - defines a set of codes with meanings (also known as enumeration, terminology, classification, and/or ontology)
* **value set** - selects a set of codes from those defined by one or more code systems

Code systems define which codes (symbols and/or expressions) exist, and how they are understood. Value Sets select a set of codes from one or more code systems to specify which codes can be used in a particular context.

The CodeSystem resource is used to declare the existence of a code system, and it's key properties:

* Identifying URL and version
* Description, Copyright, publication date, and other metadata
* Some key properties of the code system itself - whether it's case sensitive, version safe, and whether it defines a compositional grammar
* What filters can be used in value sets that use the code system in a ValueSet.compose element
* What properties the concepts defined by the code system

In addition, the CodeSystem resource may list some or all of the concepts in the code system, along with their basic properties (code, display, definition), designations, and additional properties.

The CodeSystem resource is not intended to support the process of maintaining a code system. Instead, the focus is on publishing the properties and optionally the content of a code system for use throughout the FHIR eco-system, such as to support value set expansion and validation. Note that the important existing (large) code systems (SNOMED CT, LOINC, RxNorm, ICD family, etc) all have their own distribution formats, and there is no intent that the CodeSystem resource be used for distributing these kind of terminologies. Instead, it is intended to be used for distributing the smaller ad-hoc code systems that are ubiqutiously encountered through out the healthcare process.

**Boundaries and Relationships**

* Code systems are used in [ValueSet](file:///C:\temp\valueset.html) resources
* The [Coding](file:///C:\temp\datatypes.html#Coding) data type refers to CodeSystem resources by their canonical URL
* The CodeSystem resource design is based on the functionality described in the [OMG CTS 2](http://www.omg.org/spec/CTS2/1.0/) specification. CodeSystem resources can be converted to CTS2 code system resources.

The CodeSystem resource defines the content of a code system, and also it's preferred identifier. The NamingSystem resource identifies the existence of a code or identifier system, and its possible and preferred identifiers. The key difference between the resources is who creates and manages them - CodeSystem resources are managed by the owner of the code system resource, who can properly define the features and content of the code system. NamingSystem resources, on the other hand, are frequently defined by 3rd parties that encounter the code system in use, and need to describe the use, but do not have the authority to define the features and content. Additionally, there may be multiple authoritative NamingSystem resources for a code systemn, but there should only be one CodeSystem resource.

**Background and Context**

When using code systems and value sets, proper differentiation between a code system and a value set is important. This is one very common area where significant clinical safety risks occur in practice. Implementers should be familiar with the content in [Using Codes in resources](file:///C:\temp\terminologies.html).

Each code system has 2 different URLs that can be used to reference it - its logical identifier, and its location.

The location of the code system is a URL by which it may be retrieved, usually from a FHIR server, and may be a relative reference to a code system on the same server. The logical identifier is in the code system itself, in [CodeSystem.url](file:///C:\temp\codesystem-definitions.html#CodeSystem.url). This is the logical identity (sometimes called the canonical URL) that refers to this code system across all systems. Ideally, the URL should also be the location of the master version of the code system, though this is not always possible.

For example, the code systems published as part of FHIR all have a logical URL which is also a location by which they may be accessed in the FHIR specification itself. However, while a new version of the FHIR Specification is being prepared, code systems that are published in the drafts will not be found in the current FHIR specification.

Because it is common practice to copy (cache) code systems locally, most references to code systems can be either a logical or a literal URL.

**CodeSystem Identification**

A code system has 3 identifiers:

* CodeSystem.id: the [logical id](file:///C:\temp\resource.html#id) on the system that holds the code system - this changes as it moves from server to server (this id, with the server address prepended, is called the 'literal identity' of the resource)
* CodeSystem.url: the canonical url that never changes for this code system - it is the same in every copy. Ideally, the URL should also be the location of the master version of the code system, though this is not always possible
* CodeSystem.identifier: A system/value pair that is used to identify the code system in other contexts (such as an OID in an [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) specification)

For further information regarding resource identification, see [Resource Identity](file:///C:\temp\resource.html#id).

This means that each code system has 2 different URLs that can be used to reference it - its canonical url, and its local location from which it may be retrieved. Because it is common practice to copy (cache) code systems locally, most references to code systems use the canonical URL.

For example, the code systems published as part of FHIR all have a canonical URL which is also a location by which they may be accessed in the FHIR specification itself. Note, though, that while a new version of the FHIR Specification is being prepared, code systems that are published in the drafts will not be found in the published FHIR specification at their canonical URL.

Alternatively, the identifier and version elements may be used to reference this code system in a design, a profile, a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) template or [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) message (in the CD data type codeSystem and codeSystemVersion properties). These different contexts may make additional restrictions on the possible values of these elements. The identifier is generally not needed when using code systems in a FHIR context, where the canonical URL is always the focus.

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**Versioning Code Systems**

Most code systems evolve over time, due to corrections, clarifications, and changes to approach or underlying knowledge or reality. If these changes lead to the meanings of existing codes changing significantly, then the interpretation of the code system becomes version dependent. This significantly complicates implementation based on the code system, to the point where it is not clear that safety can be assured, so changing the meaning of an existing code SHOULD be avoided whenever possible. It is preferable to assign a new identifier to a code system when any concepts in it have a significant change in meaning (for example, the German diagnostic classification code system ICD10GM2009 has a different *system* to ICD10GM2008), but this also can have substantial impact on implementation, so is often not practical - for instance, [SNOMED CT](file:///C:\temp\snomedct.html) has a complex version release framework, which may lead to variations in meaning of concepts, but there is only one identifier for SNOMED CT.

For this reason, a code system MAY provide a version identifier which can be specified in CodeSystem.version. The version specific identifier SHOULD be provided whenever there are potentially significant changes in meaning across multiple releases of a code system. There is no particular format requirement for the version identifier, though HL7 recommends a date based approach.

When the CodeSystem.versionNeeded is 'true', then the version identifier SHALL be used in [Coding](file:///C:\temp\datatypes.html#coding) instances that refer to the code system.

Where the terminology does not clearly define what string should be used to identify code system versions, the recommendation is to use as the version string the date (expressed in FHIR date format) on which the version of the code system that is being used was officially published.

**Properties**

Each code system can have one or more properties. Each concept defined by the code system may have one more values for each property defined by the code system. Typical uses for properties include:

* Tracking administrative status (inactive, deprecation date)
* Providing additional statements about the meaning of the concept
* Defining structured relationships with other concepts in the code system
* Assigning scoring values to the concepts

Properties are identified by their master URI (CodeSystem.property.uri), and then, by their code (CodeSystem.property.code), which is used both internally within the code system resource (CodeSystem.concept.property.code) and also externally, in the following places:

* [ConceptMap](file:///C:\temp\conceptmap-definitions.html#ConceptMap.group.element.target.dependsOn.property): ConceptMap.element.target.dependsOn.property and ConceptMap.element.target.product.property
* [ValueSet](file:///C:\temp\valueset-definitions.html#ValueSet.compose.include.filter.property): ValueSet.compose.include.filter.property can refer to any defined code system property
* [$lookup operation](file:///C:\temp\codesystem-operations.html#lookup): In Parameters.parameter.name when returning information about a code
* [$translate operation](file:///C:\temp\conceptmap-operations.html#translate): In Parameters.parameter.part.name for dependencies and products
* [$infer operation](file:///C:\temp\codesystem-operations.html#infer): In Parameters.parameter.name when providing codes, and in Parameters.parameter.name when asking for codes

Properties are defined using the following elements:

|  |  |  |
| --- | --- | --- |
| **Name** | **Details** | **Description** |
| code | [code](file:///C:\temp\datatypes.html#code) | Used to identify the property, as enumerated above |
| uri | optional [uri](file:///C:\temp\datatypes.html#code) | Reference to the formal meaning of the property. One possible source of meaning is the [Concept Properties](file:///C:\temp\codesystem-concept-properties.html) code system. This part of the definition is optional, but is recommended to provide an additional level of definitional consistency |
| description | optional [string](file:///C:\temp\datatypes.html#code) | A description of the property- why it is defined, and how it's value might be used |
| type | code | Coding | string | integer | boolean | dateTime | The type of the property value. Properties of type "code" contain a code defined by the code system (e.g. a reference to anotherr defined concept) |

Note that properties provide a common view of concept relationships that is common across all code systems. Some code systems define properties with more sophistication, such as groups of properties, or subsumption relationships between properties (e.g. SNOMED CT). Servers providing support for these code systems will need to know full details about the underlying relationships in order to provide the correct information about concepts and their properties, but this information does not surface in the resources or operations defined by the FHIR specification.

**Concept Status**

Many Code Systems have a 'status' associated with the concept. This may categorise the concept as:

* Experimental - provided for trial, but may be removed in the future
* Active - in normal use
* Deprecated - planned to be removed from use
* Retired - still present for historical reasons, but no longer allowed to be used

There is wide variation in the life cycles supported by the different code systems, the words they use to describe the various status values they use, and some code systems have additional status values. HL7 uses Active and Retired. In addition to these status codes, concepts may be also be labelled as "Abstract' (not to be used in some circumstances), and have dates associated with their retirement or deprecation. All this information is represented as properties of the concepts. In order to assist with consistency between code systems, the following basic property URIs are defined:

|  |  |
| --- | --- |
| http://hl7.org/fhir/concept-properties#status | A property that indicates the status of the concept. If the property is identified by this URL, then it SHALL use at least these status values (where appropriate):   * active - the concept is for normal use (this is the default value) * experimental - provided for trial, but may be removed in the future * deprecated - planned to be removed from use * retired - still present for historical reasons, but no longer allowed to be used |
| http://hl7.org/fhir/concept-properties#retirementDate | Date Concept was retired |
| http://hl7.org/fhir/concept-properties#deprecationDate | Date Concept was deprecated |
| http://hl7.org/fhir/concept-properties#parent | An immediate parent of the concept in the heirarchy |
| http://hl7.org/fhir/concept-properties#child | An immediate child of the concept in the heirarchy |
| http://hl7.org/fhir/concept-properties#notSelectable | This concept is a grouping concept and not intended to be used in the normal use of the code system (though my be used for filters etc). This is also known as 'Abstract' |

Typically, Code systems are presented hierachically, where the hierachy has [a defined meaning](file:///C:\temp\codesystem-definitions.html#CodeSystem.hierarchyMeaning). For this reason, the parent and child properties are mostly only used when performing concept lookup. Note that in some code systems, concepts may have multiple parents, so the parent property may repeat. These code systems are not usually presented in a hierachical fashion in a CodeSystem if they are represented in a CodeSystem at all. If they are, then the [subsumes extension](file:///C:\temp\extension-codesystem-subsumes.html) must be used.

**Subsumption Testing**

The words 'subsume', 'subsumes', 'subsumed' and 'subsumption' are defined in terms of the CodeSystem hierarchy (i.e. [CodeSystem.hierarchyMeaning](file:///C:\temp\codesystem-definitions.html#CodeSystem.hierarchyMeaning)). Concept A is considered to be subsumed by Concept B if it comes under Concept B in the heirarchy, or if subsumption is declared explicitly using the [subsumes extension](file:///C:\temp\extension-codesystem-subsumes.html)).

Where a CodeSystem does not declare it's hierarchy meaning directly, then the code system documentation must be consulted manually to determinw how subsumption is determined. If there is no definition, none of the subsumption based features can be used with the code system.

Subsumption based logic arises explicitly or implicitly in the following places in the FHIR specification:

* [CodeSystem $subsumes operation](file:///C:\temp\codesystem-operations.html#subsumes)
* [CodeSystem $lookup operation](file:///C:\temp\codesystem-operations.html#lookup)
* [ConceptMap $closure operation](file:///C:\temp\conceptmap-operations.html#closure)
* [Search by subsumption](file:///C:\temp\search.html#subsumption)
* [ValueSet $expand operation](file:///C:\temp\valueset-operations.html#expand)
* [ValueSet $validate-code operation](file:///C:\temp\valueset-operations.html#validate-code)

**Filters**

The following filters are defined for all code systems:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property Name** | **Operation** | **Value** | **Definition** | **Notes** |
| [property] | = | [string] | Includes all codes that have a property value equal to the specified string, where [property] is the code for any [defined property](file:///C:\temp\intros%20and%20notes.html#properties) |  |
| [property] | in | [string,string...] | Includes all codes that have a property value equal to one of the specified strings, where [property] is the code for any [defined property](file:///C:\temp\intros%20and%20notes.html#properties) | The values cannot include ",", since it is being used as a delimited |

**Code systems with detailed metadata**

Sometimes code systems may be used to represent more complex information than just code, display name and code system. For example, a code system of drug information which contains information about the content of the medication (e.g., RxNorm), or a set of observation types, that contain methods, units, etc. (e.g., LOINC). In FHIR, these are handled by splitting the concept into two distinct parts - the Terminology, (**Code System** & ValueSet resources) is used to manage the codes, display names and relationships. A separate "detail" resource (e.g., [Medication](file:///C:\temp\medication.html) for drugs,[DataElement](file:///C:\temp\dataelement.html) for observation types, [Location](file:///C:\temp\location.html) for location, etc.) is used to convey detailed information (dose form & strength, allowed data type or permitted values, address & hours of operation, etc.). One "detail" resource instance is created for each code.

This division accomplishes several things:

* It allows generic systems that support terminology management to perform standard terminology operations on code systems dealing with complex structures - code lookup, validation, subsumption testing, mapping and translation.
* It allows information to be exchanged about individual medications, data elements and locations. Codes can't be retrieved individually in FHIR - it is necessary to retrieve the entire resource. By packaging the detailed information in separate resources, independent retrieval and update is possible.
* It supports use-cases for sharing medication, location, observation type and similar information in circumstances where the code may be unknown, unavailable or occasionally non-existent (e.g., custom compounds, non-registered locations). Having a distinct resource supports these capabilities, which would not be possible using CodeSystem/ValueSet.

Note that this division in FHIR does not imply that a similar division is required in the internal representation used by systems exposing a FHIR interface. Similarly, some systems may choose to only expose or maintain one aspect of such information types (i.e. only the discrete resource instances or only the value set).

The linkage between the "detail" resource and the Terminology resources is accomplished via the code element (or equivalent) on the detail resource. As well, the "name" or "title" on the detail resource generally corresponds with the display name on the matching code. Most detail resources will also have an "identifier" element. This *can* be set to the same value and namespace as the code, but if the only identifier a resource has is its defining code, it may be better to omit the identifier entirely. For further information, see [Implicit Code Systems](file:///C:\temp\conceptmap.html#implicit).

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**Scope and Usage**

A concept map defines a mapping from a set of concepts defined in [a code system](file:///C:\temp\terminologies.html) to one or more concepts defined in other code systems. Mappings are one way - from the source to the destination. In many cases, the reverse mappings are valid, but this cannot be assumed to be the case.

Mappings between code systems are only defined in the context of the specified source and destination [value sets](file:///C:\temp\valueset.html) - they are specific to a particular context of use. The mappings may be useful in other contexts, but this must be determined based on the context of use and meaning; it cannot be taken for granted automatically. Note that all code systems have value sets that include the entire code system, and these value sets can be used for mappings that are valid in all contexts.

Each mapping for a concept from source to target includes an [equivalence](file:///C:\temp\valueset-concept-map-equivalence.html) property that specifies how similar the mapping is (or, in some cases, that there is no valid mapping). There is one element for each concept or field in the source that needs to be mapped. Each source concept may have multiple targets:

* because there are multiple possible mappings (e.g., ambiguous)
* to specify a correct map, and specify other mappings as invalid
* when there are multiple mappings depending on the values of other elements (dependsOn)

There SHOULD be at least one target for each element, but some incomplete concept maps may not have a target for each concept.

**Boundaries and Relationships**

While ConceptMap resources are not referred to directly from any other resource, they may be included and used in [ImplementationGuide](file:///C:\temp\implementationguide.html) resources, and provide background knowledge that is in many contexts, including [operations](file:///C:\temp\operations.html) defined in this specification.

In addition to ConceptMap, there is also the [StructureMap](file:///C:\temp\structuremap.html) resource. The ConceptMap resource defines relationships between concepts in their own right, along with grading of their equivalencies, while the StructureMap defines an exectuable transform for instances that conform to a known structure.

**Background and Context**

Further discussion of the issues involved in mapping between concept definition systems can be found in the [HL7 v3 Core Principles](http://www.hl7.org/documentcenter/public/standards/V3/core_principles/infrastructure/coreprinciples/v3modelcoreprinciples.html) document and the functionality described in the [OMG CTS 2](http://www.omg.org/spec/CTS2/1.0/) specification.

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**Notes**

* The value of the system, version and code elements are the same as used by the [Coding](file:///C:\temp\datatypes.html#Coding) data type
* When a mapping equivalence is characterized as "narrower", some explanation of the scope difference SHALL be provided in the comments
* The concept map is a statement of mapping in a single direction. The existence of a matching mapping in the reverse direction cannot be assumed to exist automatically, but only through human review.
* There should be only one element for each source concept. If there is more than one, the target statements are cumulative across them

**Grouping Mappings**

The concept mappings in element are arranged into groups that share common source/target systems. These groups have no semantic signficance; they exist to make the representation more concise. Concept maps may contain more than one group with the same source and target - this would be a less concise representation but may be useful in order to maintain a fixed order for the concepts that are mapped.

Concepts that are labelled as 'unmatched' are considered to be unmatched in the target value set, irrespective of whether they are contained in a group with a stated target system or not. Groups that contain no target system may only contained 'unmatched' concepts. There is no difference in the meaning of an unmatched target whether or not there is a stated target system.

**Implicit Code Systems**

The ConceptMap resource is intended to map between concepts defined in a code system. It can also be useful to use the ConceptMap resource to define relationships between concepts defined in other kinds of resources. Here are some common kind of conceptual maps:

* Between two elements in different [structure definitions](file:///C:\temp\structuredefinition.html) (e.g. between CDA and FHIR v2)
* Between a question in a [Questionnaire](file:///C:\temp\questionnaire.html) and a [DataElement](file:///C:\temp\dataelement.html)
* Between a code system and a [Medication](file:///C:\temp\medication.html) resource

Though these resources are not explicitly defining code systems, they do define 'concept's that can still usefully be treated as code systems for the sake of subsetting (e.g. [ValueSet](file:///C:\temp\valueset.html)) and defining relationships (e.g. ConceptMap). Note that this is different from [StructureMap](file:///C:\temp\structuremap.html) because that is intended to define an executional transform between structures, not a conceptual model.

This table summarizes how to treat these items as a terminology:

|  |  |
| --- | --- |
| StructureDefinition | The StructureDefinition.url (canonical URL) is the system. Each .snapshot.element.id in the snapshot is a code in the code system |
| Questionnaire | The Questionnaire.url (canonical URL) is the system. Each .item.linkId in the snapshot is a code in the code system. Items with no linkId cannot be addressed |
| DataElement | The DataElement.url (canonical URL) is the system. Each .element.id in the snapshot is a code in the code system. Elements with no id cannot be addressed |
| Medication | Medication resources are a bit different, since they don't have a canonical URL, and there are not multiple items in a resource. So to refer to a medication resource, the system is [base]/Medication, where base is the server address. The [Logical Id](file:///C:\temp\resource.html#id) of the resource is the code |

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**Scope and Usage**

The purpose of the expansion profile is to allow a client that is using a terminology service to configure the behaviour of the terminology server in regard to how it builds expansions - and, in a similar manner, how it validates codes in value set. ExpansionProfiles are used for the following operations:

* [Value Set Expansion](file:///C:\temp\valueset-operations.html#expand)
* [Value Set based Validation](file:///C:\temp\valueset-operations.html#validate-code)

The ExpansionProfile can be passed either directly, or as a reference by it's canonical URL.

**Boundaries and Relationships**

The ExpansionProfile is used to configure the behaviour of a terminology server when it processes [ValueSet](file:///C:\temp\valueset.html) resources. As such, there is a tight relationship between the two resources; ValueSets specify what codes are in the value set, while ExpansionProfile affect run time behaviour.

ExpansionProfiles do not change what codes are in a defined value set. They can never add codes to the value set. They can be used to reduce the number of codes returned in an expansion, but this is a reduced view of the value set, not a change in the value set itself. Note, though, the [discussion about overriding versions below](file:///C:\temp\intros%20and%20notes.html#overrides).

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**Overriding Versions**

The ExpansionProfile resources allows a client to specify a particular version to use for a given code system, and that this version is used **irrespective** of any version stated in any value set. This has obvious safety issues, in that it may result in a value set expansion giving a different list of codes that is both wrong and unsafe, and implementers should only use this capability reluctantly. This feature is primarily defined to allow implementers to deal with situations where specifications have fallen into decay as time passes, and the specified versions of code systems can no longer be used at all.

In principle, well designed specifications should not be authored in a fashion that allows them to decay in this fashion, but the technical infrastructure, eco-system, and community are not yet in a position to make this a reality. For this reason, clients are allowed to override versions. Clients setting the ExpansionProfile.fixedVersion.mode to override need to ensure that this action is not unsafe in their context.

**Excluding Codes**

Some fields in the ExpansionProfile can result in the return of an expansion that contains a reduced set of information in the expansion. if any of these fields may alter the expansion, terminology servers SHALL mark their use in the ValueSet.expansion.parameters with the matching parameter name:

|  |  |
| --- | --- |
| ExpansionProfile.fixedVersion | fixedVersion (in addition to the normal 'version' parameter) |
| ExpansionProfile.activeOnly | activeOnly |
| ExpansionProfile.excludeNotForUI | excludeNotForUI |
| ExpansionProfile.excludePostCoordinated | excludePostCoordinated |
| ExpansionProfile.limitedExpansion | limitedExpansion (in addition to the the extension [http://hl7.org/fhir/StructureDefinition/valueset-toocostly](file:///C:\temp\extension-valueset-toocostly.html)) |

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As well as the specific example below, there are many value sets published as part of defining other resources. See:

* [FHIR Valuesets](file:///C:\temp\terminologies-valuesets.html)
* [HL7 v2 Tables](file:///C:\temp\terminologies-v2.html)
* [HL7 v3 Code systems and Value sets](file:///C:\temp\terminologies-v3.html)

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**Scope and Usage**

The FHIR terminology specification is based on two key concepts, originally defined in [HL7 v3 Core Principles](http://www.hl7.org/documentcenter/public/standards/V3/core_principles/infrastructure/coreprinciples/v3modelcoreprinciples.html):

* [CodeSystem](file:///C:\temp\codesystem.html) - defines a set of codes with meanings (also known as enumeration, terminology, classification, and/or ontology) - e.g. define which codes (symbols and/or expressions) exist, and how they are understood
* ValueSet - selects a set of codes from those defined by one or more code systems to specify which codes can be used in a particular context

Value sets have 2 aspects:

* .compose: A definition of which codes are intended to be in the value set ("intension")
* .expansion: The list of codes that are actually in the value set under a given set of conditions ("extension")

The ValueSet resource can carry either the .compose or the .expansion, or both. There is a ["$expand" operation](file:///C:\temp\valueset-operations.html#expand) which can be used to ask a server to generate an expansion given the composition rules.

**Boundaries and Relationships**

* Value sets use [CodeSystem](file:///C:\temp\codesystem.html) resources by referring to them via their canonical URLs
* Value sets are used in [ElementDefinition](file:///C:\temp\elementdefinition.html) and [Questionnaire](file:///C:\temp\questionnaire.html) resources to specify the allowable contents for coded elements
* [Concept Maps](file:///C:\temp\conceptmap.html) describe mappings between value sets
* The ValueSet resource design is based on the functionality described in the [OMG CTS 2](http://www.omg.org/spec/CTS2/1.0/) specification, along with metadata in the HL7 Value Set Definition specification. Value set resources can be converted to CTS2 value set and code system resources.
* The value set resource is aligned with the [Value Set Definition](http://wiki.hl7.org/index.php?title=Value_Set_Definition_Standard_Project) (VSD) project. Not all of the elements defined by the VSD are part of the base resource - some are defined as part of the [ValueSet Extensions](file:///C:\temp\valueset-extensions.html). In the ValueSet resource, the compose element is the VSD "Content Logical definition".

**Background and Context**

When using value sets, proper differentiation between a code system and a value set is important. This is one very common area where significant clinical safety risks occur in practice. Implementers should be familiar with the content in [Using Codes in resources](file:///C:\temp\terminologies.html).

**ValueSet Identification**

A value set has 3 identifiers:

* ValueSet.id: the [logical id](file:///C:\temp\resource.html#id) on the system that holds the value set - this changes as it moves from server to server (this id, with the server address prepended, is called the 'literal identity' of the resource)
* ValueSet.url: the canonical url that never changes for this value set - it is the same in every copy. Ideally, the URL should also be the location of the master version of the value set, though this is not always possible
* ValueSet.identifier: A system/value pair that is used to identify the value set in other contexts (such as an OID in an [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) specification)

For further information regarding resource identification, see [Resource Identity](file:///C:\temp\resource.html#id).

This means that each value set has 2 different URLs that can be used to reference it - its canonical url, and its local location from which it may be retrieved. Because it is common practice to copy (cache) value sets locally, most references to value sets use the canonical URL.

For example, the value sets published as part of FHIR all have a canonical URL which is also a location by which they may be accessed in the FHIR specification itself. Note, though, that while a new version of the FHIR Specification is being prepared, value sets that are published in the drafts will not be found in the published FHIR specification at their canonical URL.

Alternatively, the identifier and version elements may be used to reference this value set in a design, a profile, a [CDA](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) template or [HL7 v3](https://www.hl7.org/implement/standards/product_brief.cfm?product_id=186) message (in the CD data type valueSet and valueSetVersion properties). These different contexts may make additional restrictions on the possible values of these elements. The identifier is generally not needed when using value sets in a FHIR context, where the canonical URL is always the focus.

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**Composition Rules**

A value set can be a simple list of included codes, or it can be some kind of general selection criteria using the facilities provided by the code system. For these value sets:

* Multiple include statements are cumulative - e.g. the value set contains the union of all the includes
* Within an include, all the criterion apply -e.g. the value set contains the intersection of the criterion
* Within an include, a single system with selection criteria may be listed, and/or one or more value sets may be listed. Rules for interpretation:
  + **System only**: Codes are 'selected' for inclusion if they are selected by the code system selection (see next point)
  + **valueSet only**: Codes are 'selected' for inclusion if they are in all the referenced value sets
  + **System and valueSet**: Codes are 'selected' for inclusion if they are selected by the code system selection and if they are in all the referenced value sets
* If a system is specified, the following rules apply:
  + **no concept or filter**: All codes in the system are included
  + **concept**: Only the enumerated codes are selected
  + **filter**: Any codes meeting the filter criteria are selected
* If the system reference is not version specific and filters are present, then the contents of the value set are open and change over time as the underlying code systems are updated
* Using the property filters is only possible where the code system in use defines the relevant properties. Note that in some cases the underlying code system defines the logical concepts but not the syntax for exercising them. In such cases, the literal definitions may be provided by a third party
* In addition to include rules, codes may be excluded. Rules for interpretation of exclude statements match those for includes, but codes in the exlude statements are never in the value set
* Value sets may include abstract codes - that is, codes designated by the underlying code system as not for use as a selectable concept in a particular context. These abstract codes are typically used as a grouping/searching mechanism, and can be included either by enumerating them, or by using a filter.

When a value set enumerates codes, it is sometimes useful to define an alternative display for the code that is to be used wherever the value set is expanded and used in a UI. This facility is provided to cover the following circumstances:

* The system that defines the code or expression doesn't provide a display for this code (or any codes).
* The system that defines the code or expression defines multiple choices for display.
* The system provides a very long display name that is unnecessary or inappropriate in the context of this value set (e.g. a display name of "Glucose [Mass/volume] in Serum or Plasma --10 PM specimen" for LOINC code 48991-4, when the value set only includes Glucose mass/vol in serum/plasma codes). As the display names get longer, this becomes more important.

Note that care must be taken in order to avoid "changing the meaning" of the concept by implying that it means something other than the explicit definition of the concept in the underlying code system (e.g., in the case above, using a display of "Glucose Concentration at 10pm"). For this reason, some contexts of use do not allow a display to be associated with a specific code in a value set.

Any display name for a concept provided in the value set is only used in the UI. The display in a [Coding](file:///C:\temp\datatypes.html#Coding) must be taken from the underlying code system definition, even if a value set is referenced explicitly in the Coding (e.g. by an extension). The alternative display specified in the value set would go in [CodeableConcept](file:///C:\temp\datatypes.html#CodeableConcept).text, perhaps appended to the UI label for the matching data element.

**Value Sets with multiple code systems**

Value sets may select codes from multiple code systems - either by including codes from different systems, or importing other value sets that include them. A typical use for crossing code systems is when including a set of codes, and adding a few additional codes to cover cases not catered to by the included codes (e.g. Data missing or workflow error codes).

Best Practice Note: Mixing definitional systems offers the potential for confusing, overlapping, and inconsistent definitions. Creating value sets that cross code systems should be done with care to avoid creating definitional confusion.

**Code systems Note**

Each [Code System](file:///C:\temp\codesystem.html) defines which filters can be used in ValueSet.compose.include.filter. All code systems have [base filters](file:///C:\temp\codesystem.html#filter) and any additional filters defined in in ([CodeSystem.filter)](file:///C:\temp\codesystem-definitions.html#CodeSystem.filter).

This specification also defines filters for various published code systems:

* [LOINC Filters](file:///C:\temp\loinc.html#filters)
* [Using CT Filters](file:///C:\temp\snomedct.html#filters)
* [RxNorm Filters](file:///C:\temp\rxnorm.html#filters)
* [UCUM Filters](file:///C:\temp\ucum.html#filters)
* [Using Metathesaurus Filters](file:///C:\temp\ncimeta.html#filters)
* [CPT Filters](file:///C:\temp\cpt.html#filters)
* [NDF-RT Filters](file:///C:\temp\ndfrt.html#filters)

**Value Set Expansion**

A value set can be "expanded", where the definition of the value set is used to create a simple collection of codes suitable for use for data entry or validation. There is a [defined operation $expand](file:///C:\temp\valueset-operations.html) to ask a server to perform this expansion. Expansions are most useful when a value set includes all the codes in a code system, or a set of codes by filter.

A resource that represents a value set expansion includes the same identification details as the definition of the value set, and MAY include the definition of the value set (.compose). In addition, it has an .expansion element which contains the list of codes that constitute the value set expansion. If the expansion has nested contains elements, there is no implication about the logical relationship between them, and the structure cannot be used for logical inferencing. The structure exists to provide navigational assistance for helping human users to locate codes in the expansion.

When a request for an expansion is received (e.g., for the [$expand](file:///C:\temp\valueset-operations.html#expand) operation), the following process should be followed:

* If the value set already has an expansion (e.g., a stored expansion), simply take the existing expansion as it is. If not, then:
* For each *compose.include*:
  1. If there is a system, identify the correct version of the code system, and then:
     + If there are no codes or filters, add every code in the code system to the result set.
     + If codes are listed, check that they are valid, and check their active status, and if ok, add them to the result set (the profile parameter to the $expand operation may be used to control whether active codes are included).
     + If any filters are present, process them in order (as explained above), and add the intersection of their results to the result set.
  2. For each valueSet, find the referenced value set by ValueSet.url, expand that (e.g., using the [$expand](file:///C:\temp\valueset-operations.html#expand) operation: GET [base]/ValueSet/$expand$url=[compose.include.valueSet]), and add it to the result set. This means that expansion across imports is a recursive process.
  3. Add the intersection of the result set from the system and the result sets from the value sets to the expansion
* For each *compose.exclude*, follow the same process as for *compose.include*, but remove any codes from the result set, instead of adding them.

The final "result set" is then represented in *expansion*. Note that the expansion structure is inherently ordered, and also provides support for a hierarchical tree of items. This specification does not fix the meaning of use of either the order or the heirarchy, and the conceptual approach described should not be understood to prohibit any implementation approach in these regards. In addition, note that the method described above is a conceptual approach; individual servers may choose to follow alternative approaches that are more efficient, as long as the outcome is the same.

An expansion may include entries in the expansion that only serve an arbitrary grouping purpose, to make it easier for a human to use the list. These entries have no system or code, and must be marked as abstract. Note that the CodeSystem resource and ValueSet.compose offer no support for defining heirarchies and groups, but this does not exclude servers from using extensions or other knowledge to introduce such groups as an implementation feature.

The codes in the expansion should be treated as case sensitive - implementers should use the correct case. Implementers can consult the definition of the underlying code systems to determine whether the code system that defines the code is case sensitive or not.

It is important that expansions be identified properly. Any value set definition may produce an infinite number of expansions, depending on the expansion profile and $expand operation parameters. Any expansions produced must be clearly identified so that there is no confusion. The following rules apply:

* The canonical URL for the expansion is the same as the value set it was expanded from
* Each expansion SHALL have a unique identifier in ValueSet.expansion.identifier
* The result of an $expand operation may use the same identifier in ValueSet.expansion.identifier as a previous expansion, but if it does, the canonical representation of the value set expansion SHALL be identical (e.g. a cached response)

Whether to store expanded value sets, or simply to store their definitions and expand on the fly is a matter for system deployment. Some servers, including public value sets servers, only store expansions. However any system that stores an expansion must be concerned with how to determine whether the expansion is still current, and this requires deep knowledge of how the expansion was created. A system with a dedicated terminology server that returns expansions on demand avoids this problem, but leaves open the question of how to audit the specific expansion that was used for a particular case. One solution to this is to use a dedicated terminology server, and have the clients ask for expansions on demand based on the value set definitions, and for the server to store (and reuse as appropriate) the returned expansion (when it reuses the expansion, ValueSet.expansion.identifier will be the same). If expansions are shared, users need to be aware of how expansion identifiers (which may be server specific) work.