

RamSoft

FHIR Capability Statement

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1 Overview

The following document details RamSoft's FHIR compatibility statement meeting standard FHIR conformance guidelines.

Important Note: All sections included in this document references the FHIR standards version R4 located here - <https://hl7.org/fhir/R4/>.

2 Capability Statement

This is the Capability Statement for Ramsoft RapidResults v7. It represents a server that provides the set of functionalities implemented defined by FHIR R4.

Note: the following sections reference the FHIR standards version R4 located here - <http://hl7.org/fhir/R4/capabilitystatement.html>.

2.1 Resource Capability Statement Overview

The Capability Statement documents a set of capabilities (behaviors) of a FHIR Server for a particular version of FHIR that may be used as a statement of actual server functionality or a statement of required or desired server implementation.

2.1.1 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](#) and [ValueSets](#). This composite statement of application capability may be used for system compatibility testing, code generation, or as the basis for a conformance assessment. For further information about Conformance testing, see [Conformance Rules](#) and [Profiling FHIR](#).

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

Instance	<code>implementation</code> must be present and <code>software</code> may be present
Capability	<code>implementation</code> must be absent, <code>software</code> must be present
Requirements	<code>implementation</code> and <code>software</code> must be absent

2.1.2 Instance: 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 statement 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.

2.1.3 Capability: 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.

2.1.4 Requirements: 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.

CapabilityStatements of type "requirement" describe what capabilities are potentially relevant; additional documentation or extensions (see [capabilitystatement-expectation](#)) within the CapabilityStatement are expected to make more explicit statements of degree of expectation associated with each capability.

2.2 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.

2.2.1 Supporting Multiple Versions

Applications may implement multiple versions. If they do, then a **CapabilityStatement** describes the system's support for a particular version of FHIR, and the system will have multiple statements, one for each version it supports. For further information, see [Managing Multiple Versions](#), and the [\\$versions](#) operation.

2.2.2 Mixed Normative Content

While the core of the **CapabilityStatement** resource is [Normative](#), many of the flags that indicate exactly how the system operates are marked as [trial-use](#). Roughly, the portions of the resource that correspond to [OpenAPI document](#) elements are normative.

Applications looking for normative stability should only use the normative parts of the resource, and not populate or ignore the portions labelled trial-use. To assist with this, clients can ask for the server to return a 'Normative content only' CapabilityStatement using the [mode parameter on /metadata](#).

Community discussion regarding more capable, efficient and computable representations of an applications capabilities may lead to change to the trial-use parts of this resource or the creation of new resources and/or functionality in future versions of this specification.

This resource is referenced by itself and [TestScript](#)

2.3 Resource Content

2.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Note: not all features are supported by RamSoft.

Name	Flags	Card.	Type	Description & Constraints
 Capability Statement	IN		DomainResource	<p>A statement of system capabilities</p> <p>+ <i>Warning: Name should be usable as an identifier for the module by machine processing applications such as code generation</i></p> <p>+ <i>Rule: A Capability Statement SHALL have at least one of REST, messaging or document element.</i></p> <p>+ <i>Rule: A Capability Statement SHALL have at least one of description, software, or implementation element.</i></p> <p>+ <i>Rule: Messaging end-point is required (and is only permitted) when a statement is for an implementation.</i></p> <p>+ <i>Rule: The set of documents must be unique by the combination of profile and mode.</i></p> <p>+ <i>Rule: If kind = instance, implementation must be present and software may be present</i></p> <p>+ <i>Rule: If kind = capability, implementation must be absent, software must be present</i></p> <p>+ <i>Rule: If kind = requirements, implementation and software must be absent</i></p> <p>Elements defined in</p> <p>Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
 url	Σ	0..1	uri	Canonical identifier for this capability statement, represented as a URI (globally unique)

 version	Σ	0..1	string	Business version of the capability statement
 name	ΣI	0..1	string	Name for this capability statement (computer friendly)
 title	Σ	0..1	string	Name for this capability statement (human friendly)
 status	$?!\Sigma$	1..1	code	draft active retired unknown PublicationStatus (Required)
 experimental	Σ	0..1	boolean	For testing purposes, not real usage
 date	Σ	1..1	dateTime	Date last changed
 publisher	Σ	0..1	string	Name of the publisher (organization or individual)
 contact	Σ	0..*	ContactDetail	Contact details for the publisher
 description	I	0..1	markdown	Natural language description of the capability statement
 useContext	ΣTU	0..*	UsageContext	The context that the content is intended to support
 jurisdiction	Σ	0..*	CodeableConcept	Intended jurisdiction for capability statement (if applicable) Jurisdiction (Extensible)
 purpose		0..1	markdown	Why this capability statement is defined
 copyright		0..1	markdown	Use and/or publishing restrictions
 kind	ΣI	1..1	code	instance capability requirements CapabilityStatementKind (Required)
 instantiates	Σ	0..*	canonical(CapabilityStatement)	Canonical URL of another capability statement this implements
 imports	ΣTU	0..*	canonical(CapabilityStatement)	Canonical URL of another capability statement this adds to

 software	Σ	0..1	BackboneElement	Software that is covered by this capability statement
 name	Σ	1..1	string	A name the software is known by
 version	Σ	0..1	string	Version covered by this statement
 releaseDate	Σ	0..1	dateTime	Date this version was released
 implementation	Σ	0..1	BackboneElement	If this describes a specific instance
 description	Σ	1..1	string	Describes this specific instance
 url	Σ	0..1	url	Base URL for the installation
 custodian	Σ	0..1	Reference(Organization)	Organization that manages the data
 fhirVersion	Σ	1..1	code	FHIR Version the system supports FHIRVersion (Required)
 format	Σ	1..*	code	formats supported (xml json ttl mime type) MimeType (Required)
 patchFormat	Σ	0..*	code	Patch formats supported MimeType (Required)
 implementationGuide	Σ	0..*	canonical(ImplementationGuide)	Implementation guides supported
 rest	Σ	0..*	BackboneElement	If the endpoint is a RESTful one + <i>Rule: A given resource can only be described once per RESTful mode.</i>
 mode	Σ	1..1	code	client server RestfulCapabilityMode (Required)
 documentation		0..1	markdown	General description of implementation

	security	Σ TU	0..1	BackboneElement	Information about security of implementation
	cors	Σ	0..1	boolean	Adds CORS Headers (http://enable-cors.org/)
	service	Σ	0..*	CodeableConcept	OAuth SMART-on-FHIR NTLM Basic Kerberos Certificates RestfulSecurityService (Extensible)
	description		0..1	markdown	General description of how security works
	resource	Σ I	0..*	BackboneElement	Resource served on the REST interface + <i>Rule: Search parameter names must be unique in the context of a resource.</i>
	type	Σ	1..1	code	A resource type that is supported ResourceType (Required)
	profile	Σ	0..1	canonical(StructureDefinition)	Base System profile for all uses of resource
	supportedProfile	Σ TU	0..*	canonical(StructureDefinition)	Profiles for use cases supported
	documentation		0..1	markdown	Additional information about the use of the resource type
	interaction		0..*	BackboneElement	What operations are supported?
	code		1..1	code	read vread update patch delete history-instance history-type create search-type TypeRestfulInteraction (Required)
	documentation		0..1	markdown	Anything special about operation behavior
	versioning	TU	0..1	code	no-version versioned versioned-update ResourceVersionPolicy (Required)

 	TU	0..1	boolean	Whether vRead can return past versions
 	TU	0..1	boolean	If update can commit to a new identity
 	TU	0..1	boolean	If allows/uses conditional create
 	TU	0..1	code	not-supported modified-since not-match full-support ConditionalReadStatus (Required)
 	TU	0..1	boolean	If allows/uses conditional update
 	TU	0..1	code	not-supported single multiple - how conditional delete is supported ConditionalDeleteStatus (Required)
 	TU	0..*	code	literal logical resolves enforced local ReferenceHandlingPolicy (Required)
 	TU	0..*	string	_include values supported by the server
 	TU	0..*	string	_revinclude values supported by the server
 		0..*	BackboneElement	Search parameters supported by implementation
 		1..1	string	Name of search parameter
 		0..1	canonical(SearchParameter)	Source of definition for parameter
 		1..1	code	number date string token reference composite quantity uri special SearchParamsType (Required)

			0..1	markdown	Server-specific usage
	 documentation				
		Σ	0..*	BackboneElement	Definition of a resource operation
	 operation				
			1..1	string	Name by which the operation/query is invoked
		Σ	1..1	canonical(OperatorDefinition)	The defined operation/query
	 definition				
			0..1	markdown	Specific details about operation behavior
	 documentation				
			0..*	BackboneElement	What operations are supported?
			1..1	code	transaction batch search-system history-system SystemRestfulInteraction (Required)
	 documentation		0..1	markdown	Anything special about operation behavior
			0..*	see searchParam	Search parameters for searching all resources
	 searchParam				
			Σ	0..*	see operation
	 operation				Definition of a system level operation
			0..*	canonical(CompartmentDefinition)	Compartments served/used by system
	 compartment				
	 messaging	ΣITU	0..*	BackboneElement	If messaging is supported
			0..*	BackboneElement	Where messages should be sent
	 endpoint				
	 protocol		1..1	Coding	http ftp mllp + MessageTransport (Extensible)
			1..1	url	Network address or identifier of the end-point
	 address				

 reliableCache		0..1	unsignedInt	Reliable Message Cache Length (min)
 documentation		0..1	markdown	Messaging interface behavior details
 supportedMessage	Σ	0..*	BackboneElement	Messages supported by this system
 mode	Σ	1..1	code	sender receiver EventCapabilityMode (Required)
 definition	Σ	1..1	canonical(MessageDefinition)	Message supported by this system
 document	ITU	0..*	BackboneElement	Document definition
 mode	Σ	1..1	code	producer consumer DocumentMode (Required)
 documentation		0..1	markdown	Description of document support
 profile	Σ	1..1	canonical(StructureDefinition)	Constraint on the resources used in the document

2.3.2 JSON

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

Important Note: The document will specify by categories what list of FHIR R4 features RamSoft supports.

JSON Template

```
{
  "resourceType" : "CapabilityStatement",
  // from Resource: id, meta, implicitRules, and language
```

```
// from DomainResource: text, contained, extension, and modifierExtension

"url" : "<uri>", // Canonical identifier for this capability statement, represented as a URI (globally unique)

"version" : "<string>", // Business version of the capability statement

"name" : "<string>", // C? Name for this capability statement (computer friendly)

"title" : "<string>", // Name for this capability statement (human friendly)

"status" : "<code>", // R! draft | active | retired | unknown

"experimental" : <boolean>, // For testing purposes, not real usage

"date" : "<dateTime>", // R! Date last changed

"publisher" : "<string>", // Name of the publisher (organization or individual)

"contact" : [{ ContactDetail }], // Contact details for the publisher

"description" : "<markdown>", // C? Natural language description of the capability statement

"useContext" : [{ UsageContext }], // The context that the content is intended to support

"jurisdiction" : [{ CodeableConcept }], // Intended jurisdiction for capability statement (if applicable)

"purpose" : "<markdown>", // Why this capability statement is defined

"copyright" : "<markdown>", // Use and/or publishing restrictions

"kind" : "<code>", // C? R! instance | capability | requirements

"instantiates" : [{ canonical(CapabilityStatement) }], // Canonical URL of another capability statement this implements

"imports" : [{ canonical(CapabilityStatement) }], // Canonical URL of another capability statement this adds to

"software" : { // C? Software that is covered by this capability statement

  "name" : "<string>", // R! A name the software is known by

  "version" : "<string>", // Version covered by this statement

  "releaseDate" : "<dateTime>" // Date this version was released

  },

"implementation" : { // C? If this describes a specific instance

  "description" : "<string>", // R! Describes this specific instance

  "url" : "<url>", // Base URL for the installation

  "custodian" : { Reference(Organization) } // Organization that manages the data

  },

"fhirVersion" : "<code>", // R! FHIR Version the system supports

"format" : ["<code>"], // R! formats supported (xml | json | ttl | mime type)

"patchFormat" : ["<code>"], // Patch formats supported

"implementationGuide" : [{ canonical(ImplementationGuide) }], // Implementation guides supported

"rest" : [{ // C? If the endpoint is a RESTful one
```

```
"mode" : "<code>", // R! client | server
"documentation" : "<markdown>", // General description of implementation
"security" : { // Information about security of implementation
  "cors" : <boolean>, // Adds CORS Headers (http://enable-cors.org/)
  "service" : [{ CodeableConcept }], // OAuth | SMART-on-FHIR | NTLM | Basic | Kerberos | Certificates
  "description" : "<markdown>" // General description of how security works
},
"resource" : [{ // Resource served on the REST interface
  "type" : "<code>", // R! A resource type that is supported
  "profile" : { canonical(StructureDefinition) }, // Base System profile for all uses of resource
  "supportedProfile" : [{ canonical(StructureDefinition) }], // Profiles for use cases supported
  "documentation" : "<markdown>", // Additional information about the use of the resource type
  "interaction" : [{ // What operations are supported?
    "code" : "<code>", // R! read | vread | update | patch | delete | history-instance | history-type | create | search-type
    "documentation" : "<markdown>" // Anything special about operation behavior
  }],
  "versioning" : "<code>", // no-version | versioned | versioned-update
  "readHistory" : <boolean>, // Whether vRead can return past versions
  "updateCreate" : <boolean>, // If update can commit to a new identity
  "conditionalCreate" : <boolean>, // If allows/uses conditional create
  "conditionalRead" : "<code>", // not-supported | modified-since | not-match | full-support
  "conditionalUpdate" : <boolean>, // If allows/uses conditional update
  "conditionalDelete" : "<code>", // not-supported | single | multiple - how conditional delete is supported
  "referencePolicy" : ["<code>"], // literal | logical | resolves | enforced | local
  "searchInclude" : ["<string>"], // _include values supported by the server
  "searchRevInclude" : ["<string>"], // _revinclude values supported by the server
  "searchParam" : [{ // Search parameters supported by implementation
    "name" : "<string>", // R! Name of search parameter
    "definition" : { canonical(SearchParameter) }, // Source of definition for parameter
    "type" : "<code>", // R! number | date | string | token | reference | composite | quantity | uri | special
    "documentation" : "<markdown>" // Server-specific usage
  }],
}
```

```
"operation" : [{ // Definition of a resource operation
    "name" : "<string>", // R! Name by which the operation/query is invoked
    "definition" : { canonical(OperationDefinition) }, // R! The defined operation/query
    "documentation" : "<markdown>" // Specific details about operation behavior
  }]
},
"interaction" : [{ // What operations are supported?
    "code" : "<code>", // R! transaction | batch | search-system | history-system
    "documentation" : "<markdown>" // Anything special about operation behavior
  }],
"searchParam" : [{ Content as for CapabilityStatement.rest.resource.searchParam }], // Search parameters for searching all resources
"operation" : [{ Content as for CapabilityStatement.rest.resource.operation }], // Definition of a system level operation
"compartment" : [{ canonical(CompartmentDefinition) }] // Compartments served/used by system
},
"messaging" : [{ // C? If messaging is supported
    "endpoint" : [{ // Where messages should be sent
      "protocol" : { Coding }, // R! http | ftp | mllp +
      "address" : "<url>" // R! Network address or identifier of the end-point
    }],
    "reliableCache" : "<unsignedInt>", // Reliable Message Cache Length (min)
    "documentation" : "<markdown>", // Messaging interface behavior details
    "supportedMessage" : [{ // Messages supported by this system
      "mode" : "<code>", // R! sender | receiver
      "definition" : { canonical(MessageDefinition) } // R! Message supported by this system
    }]
},
"document" : [{ // C? Document definition
    "mode" : "<code>", // R! producer | consumer
    "documentation" : "<markdown>", // Description of document support
    "profile" : { canonical(StructureDefinition) } // R! Constraint on the resources used in the document
  }]
}
```

2.3.3 Terminology Bindings

Path	Definition	Type	Reference
CapabilityStatement.status	The lifecycle status of an artifact.	Required	PublicationStatus
CapabilityStatement.jurisdiction	Countries and regions within which this artifact is targeted for use.	Extensible	Jurisdiction ValueSet
CapabilityStatement.kind	How a capability statement is intended to be used.	Required	CapabilityStatementKind
CapabilityStatement.fhirVersion	All published FHIR Versions.	Required	FHIRVersion
CapabilityStatement.format CapabilityStatement.patchFormat	The mime type of an attachment. Any valid mime type is allowed.	Required	Mime Types
CapabilityStatement.rest.mode	The mode of a	Required	RestfulCapabilityMode

	RESTful capability statement.		
CapabilityStatement.rest.security.service	Types of security services used with FHIR.	Extensible	RestfulSecurityService
CapabilityStatement.rest.resource.type	One of the resource types defined as part of this version of FHIR.	Required	Resource Types
CapabilityStatement.rest.resource.interaction.code	Operations supported by REST at the type or instance level.	Required	TypeRestfulInteraction
CapabilityStatement.rest.resource.versioning	How the system supports versioning for a resource.	Required	ResourceVersionPolicy
CapabilityStatement.rest.resource.conditionalRead	A code that indicates how the server supports	Required	ConditionalReadStatus

	conditional read.		
CapabilityStatement.rest.resource.conditionalDelete	A code that indicates how the server supports conditional delete.	Required	ConditionalDeleteStatus
CapabilityStatement.rest.resource.referencePolicy	A set of flags that defines how references are supported.	Required	ReferenceHandlingPolicy
CapabilityStatement.rest.resource.searchParam.type	Data types allowed to be used for search parameters.	Required	SearchParamType
CapabilityStatement.rest.interaction.code	Operations supported by REST at the system level.	Required	SystemRestfulInteraction
CapabilityStatement.messaging.endpoint.protocol	The protocol used for	Extensible	MessageTransport

	message transport.		
CapabilityStatement.messaging.supportedMessage.mode	The mode of a message capability statement.	Required	EventCapabilityMode
CapabilityStatement.document.mode	Whether the application produces or consumes documents.	Required	DocumentMode

2.3.4 Constraints

id	Level	Location	Description	Expression
cpb-0	Warning	(base)	Name should be usable as an identifier for the module by machine processing applications such as code generation	name.matches(' [A-Z] ([A-Za-z0-9_]) {0,254} ')
cpb-1	Rule	(base)	A Capability Statement SHALL have at least one	rest.exists() or messaging.exists() or document.exists()

			of REST, messaging or document element.	
cpb -2	Rule	(base)	A Capability Statement SHALL have at least one of description, software, or implementation element.	(description.count() + software.count() + implementation.count()) > 0
cpb -3	Rule	(base)	Messaging end-point is required (and is only permitted) when a statement is for an implementation.	messaging.endpoint.empty() or kind = 'instance'
cpb -7	Rule	(base)	The set of documents must be unique by the combination of profile and mode.	document.select(profile&mode).isDistinct()
cpb -9	Rule	CapabilityStatement.rest	A given resource can only be	resource.select(type).isDistinct()

			described once per RESTful mode.	
cpb -12	<u>Rule</u>	CapabilityStatement.rest.resource	Search parameter names must be unique in the context of a resource.	searchParam.select(name).isDistinct()
cpb -14	<u>Rule</u>	(base)	If kind = instance, implementation must be present and software may be present	(kind != 'instance') or implementation.exists()
cpb -15	<u>Rule</u>	(base)	If kind = capability, implementation must be absent, software must be present	(kind != 'capability') or (implementation.exists().not() and software.exists())
cpb -16	<u>Rule</u>	(base)	If kind = requirements, implementation and software must be absent	(kind != 'requirements') or (implementation.exists().not() and software.exists().not())

2.3.5 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](#). Servers SHALL specify what resource types and operations are supported, and SHOULD also specify profiles for each resource type.
 - The CapabilityStatement returned on demand may represent the specific capabilities granted to a specific user if retrieved with that specific user's credentials, if one is in context. Servers that require authentication SHOULD still return a CapabilityStatement before authentication/authorization is performed
 - 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](#) 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.

2.3.6 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](#).

2.3.7 Search Parameters

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common n
context TU	token	A use context assigned to the capability statement	(CapabilityStatement.useContext.value as CodeableConcept)	
context-quantity TU	quantity	A quantity- or range-valued use context assigned to the capability statement	(CapabilityStatement.useContext.value as Quantity) (CapabilityStatement.useContext.value as Range)	
context-type TU	token	A type of use context assigned to the capability statement	CapabilityStatement.useContext.code	
context-type-quantity TU	composite e	A use context type and quantity- or	On CapabilityStatement.useContext: context-type: code	

		range-based value assigned to the capability statement	context-quantity: value.as(Quantity) value.as(Range)
context-type- value TU	composite e	A use context type and value assigned to the capability statement	On CapabilityStatement.useContext: context-type: code context: value.as(CodeableConcept)
date TU	date	The capability statement publication date	CapabilityStatement.date
description I U	string	The description of the capability statement	CapabilityStatement.description
fhirversion I U	token	The version of FHIR	CapabilityStatement.version
format TU	token	formats supported (xml json ttl mime type)	CapabilityStatement.format
guide TU	reference	Implementation guides supported	CapabilityStatement.implementationGuide (ImplementationGuide)
jurisdiction I U	token	Intended jurisdiction for the capability statement	CapabilityStatement.jurisdiction
mode TU	token	Mode - restful (server/client)	CapabilityStatement.rest.mode

or messaging
(sender/receiver
)

name	TU	string	Computationally friendly name of the capability statement
------	-----------	------------------------	---

publisher	TU	string	Name of the publisher of the capability statement
-----------	-----------	------------------------	---

resource	TU	token	Name of a resource mentioned in a capability statement
----------	-----------	-----------------------	--

resource-profile	TU	reference	A profile id invoked in a capability statement
------------------	-----------	---------------------------	--

security-service	TU	token	OAuth SMART- on-FHIR NTLM Basic Kerberos Certificates
------------------	-----------	-----------------------	--

software	TU	string	Part of the name of a software application
----------	-----------	------------------------	--

status	TU	token	The current status of the capability statement	CapabilityStatement.status
supported-profile	TU	reference	Profiles for use cases supported	CapabilityStatement.rest.resource.supportedProfiles (StructureDefinition)
title	TU	string	The human-friendly name of the capability statement	CapabilityStatement.title
url	TU	uri	The uri that identifies the capability statement	CapabilityStatement.url
version	TU	token	The business version of the capability statement	CapabilityStatement.version

2.3.8 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Categories	Link
Examples	http://hl7.org/fhir/R4/capabilitystatement-examples.html#5.2.6
Detailed Descriptions	http://hl7.org/fhir/R4/capabilitystatement-definitions.html
Mappings	http://hl7.org/fhir/R4/capabilitystatement-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/capabilitystatement-profiles.html

3 Account

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/account.html>.

3.1 Resource Account

A financial tool for tracking value accrued for a particular purpose. In the healthcare field, used to track charges for a patient, cost centers, etc.

3.1.1 Scope and Usage

The Account resource acts as a central record against which charges, payments, and adjustments are applied. It contains information about which parties are responsible for payment of the account.

While the Account does conceptually have a balance, expressing that balance directly as a resource property is challenging due to the complexity of pricing contracts. An operation to retrieve the current balance of an account is in consideration as future work.

3.1.2 Boundaries and Relationships

The Account itself does not include information about the charges, payments or adjustments, but rather those resources, such as ChargeItem point to the account to which they apply. Payment and adjustment resources have not yet been developed.

3.2 Background and Context

The Account resource can be considered a "bucket" to which ChargeItem resources are linked. These charges are processed by a billing system, which determines the responsible parties for the balance of the account. The billing system then submits claims or sends statements to the appropriate parties. Once payment is received, an adjustment is applied to the Account. The internal calculation of balances and allocation of responsibility is expected to be internal to the billing systems. Only the inputs and outputs of the billing process is communicated in the relevant financial FHIR resources.

3.3 Resource Content

3.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

<u>Name</u>	<u>Flags</u>	<u>Card.</u>	<u>Type</u>	<u>Description & Constraints</u>
 Account	TU		DomainResource	Tracks balance, charges, for patient or cost center Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	Account number
 status	$?!\Sigma$	1..1	code	active inactive entered-in-error on-hold unknown AccountStatus (Required)
 type	Σ	0..1	CodeableConcept	E.g. patient, expense, depreciation Account Types (Example)
 name	Σ	0..1	string	Human-readable label
 subject	Σ	0..*	Reference(Patient) Device Practitioner PractitionerRole Location 	The entity that caused the expenses

			HealthcareService Organization)	
  service	Σ	0..1	Period	Transaction window
  covera	Σ	0..*	BackboneElement	The party(s) that are responsible for covering the payment of this account, and what order should they be applied to the account
  covera	Σ	1..1	Reference(Coverage)	The party(s), such as insurances, that may contribute to the payment of this account
  priority	Σ	0..1	positiveInt	The priority of the coverage in the context of this account
  owner	Σ	0..1	Reference(Organization)	Entity managing the Account
  descrip	Σ	0..1	string	Explanation of purpose/use
  guarant		0..*	BackboneElement	The parties ultimately responsible for balancing the Account
  party		1..1	Reference(Patient) RelatedPerson Organization)	Responsible entity
  onHold		0..1	boolean	Credit or other hold applied
 period		0..1	Period	Guarantee account during
  partOf		0..1	Reference(Account)	Reference to a parent Account

3.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
    "type": "Account",  
    "profile": {  
        "reference": "http://www.hl7.org/fhir/Account.html"  
    },  
    "interaction": [  
        {  
            "code": "read",  
            "documentation": "Read the current state of the resource"  
        },  
        {  
            "code": "create",  
            "documentation": "Create a new resource with a server assigned id"  
        },  
        {  
            "code": "update",  
            "documentation": "Update an existing resource by its id"  
        },  
        {  
            "code": "delete",  
            "documentation": "Delete a resource"  
        },  
        {  
            "code": "vread",  
            "documentation": "Read the state of a specific version of the resource"  
        },  
        {  
            "code": "patch"  
        },  
        {  
            "code": "history-instance",  
            "documentation": "Retrieve the change history for a particular resource."  
        },  
        {  
            "code": "history-type",  
            "documentation": "Retrieve the change history for all resources of a  
particular type"  
        },  
        {  
            "code": "search-type",  
            "documentation": "Search the resource type based on some filter criteria"  
        }  
    ]  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Account",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Account number  
  "status" : "<code>", // R! active | inactive | entered-in-error | on-hold | unknown  
  "billingStatus" : { CodeableConcept }, // Tracks the lifecycle of the account through the billing process  
  "type" : { CodeableConcept }, // E.g. patient, expense, depreciation  
  "name" : "<string>", // Human-readable label  
  "subject" : [{ Reference(Device|HealthcareService|Location|Organization|Patient|Practitioner|PractitionerRole) }], // The entity that caused the expenses  
  "servicePeriod" : { Period }, // Transaction window  
  "coverage" : [{ // The party(s) that are responsible for covering the payment of this account, and what order should they be applied to the account  
    "coverage" : { Reference(Coverage) }, // R! The party(s), such as insurances, that may contribute to the payment of this account  
    "priority" : "<positiveInt>" // The priority of the coverage in the context of this account  
  }],  
  "owner" : { Reference(Organization) }, // Entity managing the Account  
  "description" : "<markdown>", // Explanation of purpose/use  
  "guarantor" : [{ // The parties ultimately responsible for balancing the Account  
    "party" : { Reference(Organization|Patient|RelatedPerson) }, // R! Responsible entity  
    "onHold" : <boolean>, // Credit or other hold applied
```

```
"period" : { Period } // Guarantee account during
},
"diagnosis" : [{ // The list of diagnoses relevant to this account
  "sequence" : "<positiveInt>", // Ranking of the diagnosis (for each type)
  "condition" : { CodeableReference(Condition) }, // I R! The diagnosis relevant to the account
  "dateOfDiagnosis" : "<dateTime>", // I Date of the diagnosis (when coded diagnosis)
  "type" : [{ CodeableConcept }], // Type that this diagnosis has relevant to the account (e.g. admission, billing, discharge ...)
  "onAdmission" : <boolean>, // Diagnosis present on Admission
  "packageCode" : [{ CodeableConcept }] // Package Code specific for billing
},
"procedure" : [{ // The list of procedures relevant to this account
  "sequence" : "<positiveInt>", // Ranking of the procedure (for each type)
  "code" : { CodeableReference(Procedure) }, // I R! The procedure relevant to the account
  "dateOfService" : "<dateTime>", // I Date of the procedure (when coded procedure)
  "type" : [{ CodeableConcept }], // How this procedure value should be used in charging the account
  "packageCode" : [{ CodeableConcept }], // Package Code specific for billing
  "device" : [{ Reference(Device) }] // Any devices that were associated with the procedure
},
"relatedAccount" : [{ // Other associated accounts related to this account
  "relationship" : { CodeableConcept }, // Relationship of the associated Account
  "account" : { Reference(Account) } // R! Reference to an associated Account
},
"currency" : { CodeableConcept }, // The base or default currency
"balance" : [{ // Calculated account balance(s)
  "aggregate" : { CodeableConcept }, // Who is expected to pay this part of the balance
  "term" : { CodeableConcept }, // current | 30 | 60 | 90 | 120
  "estimate" : <boolean>, // Estimated balance
  "amount" : { Money } // R! Calculated amount
},
"calculatedAt" : "<instant>" // Time the balance amount was calculated
}
```

3.3.3 Terminology Bindings

Path	Definition	Type	Reference
Account.status	Indicates whether the account is available to be used.	Required	AccountStatus
Account.type	The usage type of this account, permits categorization of accounts.	Example	AccountTypes

3.3.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "name",
        "type": "string"
    },
    {
        "name": "owner",
        "type": "reference"
    },
    {
        "name": "patient",
        "type": "reference"
    },
    {
        "name": "subject",
        "type": "reference"
    },
    {
        "name": "status",
        "type": "token"
    },
    {
        "name": "type",
        "type": "token"
    },
    {
        "name": "type",
        "type": "token"
    }
]
```

```
        "name": "period",
        "type": "date"
    }
```

The below content displays an exhaustive sample list of Search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
identifier	token	Account number	Account.identifier	
name	string	Human-readable label	Account.name	
owner	reference	Entity managing the Account	Account.owner (Organization)	
patient	reference	The entity that caused the expenses	Account.subject.where(resolve() is Patient) (Patient)	
period	date	Transaction window	Account.servicePeriod	
status	token	active inactive entered-in-error on-hold unknown	Account.status	

subject	reference	The entity that caused the expenses	Account.subject (Practitioner , Organization , Device , Patient , HealthcareService , PractitionerRole , Location)	
type	token	E.g. patient, expense, depreciation	Account.type	

3.3.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/account-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/account-definitions.html
Mappings	http://hl7.org/fhir/R4/account-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/account-profiles.html

4 Allergy Intolerance

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/allergyintolerance.html>

Allergy Intolerance refers to risk of harmful or undesirable, physiological response which is unique to an individual and associated with exposure to a substance.

4.1 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)

4.1.1 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 might not be practical. Often the term "allergy" is used rather generically and may overlap with "intolerance", and the boundaries between these concepts might 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](#) 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](#) describes general risks to a subject, not generally based on a reaction.

AllergyIntolerance and Immunization.reaction

[Immunization.reaction](#) may be an indication of an allergy or intolerance. If this is deemed to be the case, a separate [AllergyIntolerance](#) 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](#) 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](#) or - where event-specific, [DetectedIssue](#).
- Not to be used for recording failed therapy.

4.2 Resource Content

4.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

Name	Flags	Card.	Type	Description & Constraints 
 AllergyIntolerance	ITU		DomainResource	<p>Allergy or Intolerance (generally: Risk of adverse reaction to a substance)</p> <p>+ Rule: <i>AllergyIntolerance.clinicalStatus SHALL be present if verificationStatus is not entered-in-error.</i></p> <p>+ Rule: <i>AllergyIntolerance.clinicalStatus SHALL NOT be present if verificationStatus is entered-in-error</i></p> <p>Elements defined in</p>

					Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 Identifier	Σ	0..*	Identifier		External ids for this item
 clinical Status	$?\Sigma$	0..1	CodeableConcept	active inactive resolved	AllergyIntolerance Clinical Status Codes (Required)
 verification Status	$?\Sigma$	0..1	CodeableConcept	unconfirmed confirmed refuted entered-in-error	AllergyIntolerance Verification Status Codes (Required)
 type	Σ	0..1	code	allergy intolerance - Underlying mechanism (if known)	AllergyIntoleranceType (Required)
 category	Σ	0..*	code	food medication environment biologic	AllergyIntoleranceCategory (Required)
 criticality	Σ	0..1	code	low high unable-to-assess	AllergyIntoleranceCriticality (Required)
 code	Σ	0..1	CodeableConcept	Code that identifies the allergy or intolerance	AllergyIntolerance Substance/Product, Condition and Negation Codes (Example)
 patient	Σ	1..1	Reference(Patient)	Who the sensitivity is for	
 encounter		0..1	Reference(Encounter)	Encounter when the allergy or intolerance was asserted	
 onset[x]		0..1		When allergy or intolerance was identified	
 onsetDateTime			dateTime		
 onsetAge			Age		

 onsetPeriod			<u>Period</u>	
 onsetRange			<u>Range</u>	
 onsetString			<u>string</u>	
 recordedDate	0..1	dateTime	Date first version of the resource instance was recorded	
 recorder	0..1	Reference(Practitioner PractitionerRole Patient RelatedPerson)	Who recorded the sensitivity	
 asserter	0..1	Reference(Patient RelatedPerson Practitioner PractitionerRole)	Source of the information about the allergy	
 lastOccurrence	0..1	dateTime	Date(/time) of last known occurrence of a reaction	
 note	0..*	Annotation	Additional text not captured in other fields	
 reaction	0..*	BackboneElement	Adverse Reaction Events linked to exposure to substance	
 substance	0..1	CodeableConcept	Specific substance or pharmaceutical product considered to be responsible for event	
				Substance Code (Example)

 manifestation	1..*	CodeableConcept	Clinical symptoms/signs associated with the Event SNOMED CT Clinical Findings (Example)
 description	0..1	string	Description of the event as a whole
 onset	0..1	dateTime	Date(/time) when manifestations showed
 severity	0..1	code	mild moderate severe (of event as a whole) AllergyIntoleranceSeverity (Required)
 exposureRoute	0..1	CodeableConcept	How the subject was exposed to the substance SNOMED CT Route Codes (Example)
 note	0..*	Annotation	Text about event not captured in other fields

 [Documentation for this format](#)

4.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "AllergyIntolerance",
  "profile": {
    "reference": "https://www.hl7.org/fhir/allergyintolerance.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    },
    {
      "code": "vread",
      "documentation": "Read the state of a specific version of the resource"
    }
  ]
}
```

```
        "code": "patch"
    },
    {
        "code": "history-instance",
        "documentation": "Retrieve the change history for a particular resource."
    },
    {
        "code": "history-type",
        "documentation": "Retrieve the change history for all resources of a
particular type"
    },
    {
        "code": "search-type",
        "documentation": "Search the resource type based on some filter criteria"
    }
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.



```
{ "resourceType" : "AllergyIntolerance",
  // from Resource: id, meta, implicitRules, and language
  // from DomainResource: text, contained, extension, and modifierExtension
  "identifier" : [{ Identifier }], // External ids for this item
  "clinicalStatus" : { CodeableConcept }, // C? active | inactive | resolved
  "verificationStatus" : { CodeableConcept }, // C? unconfirmed | confirmed | refuted | entered-in-error
  "type" : "<code>", // allergy | intolerance - Underlying mechanism (if known)
  "category" : ["<code>"], // food | medication | environment | biologic
  "criticality" : "<code>", // low | high | unable-to-assess
  "code" : { CodeableConcept }, // Code that identifies the allergy or intolerance
  "patient" : { Reference(Patient) }, // R! Who the sensitivity is for
  "encounter" : { Reference(Encounter) }, // Encounter when the allergy or intolerance was asserted
  // onset[x]: When allergy or intolerance was identified. One of these 5:
  "onsetDateTime" : "<dateTime>",
  "onsetAge" : { Age },
  "onsetPeriod" : { Period },
  "onsetRange" : { Range },
  "onsetString" : "<string>",
  "recordedDate" : "<dateTime>", // Date first version of the resource instance was recorded
  "recorder" : { Reference(Practitioner|PractitionerRole|Patient|RelatedPerson) }, // Who recorded the sensitivity
```

```
"asserter" : { Reference(Patient|RelatedPerson|Practitioner|PractitionerRole) }, // Source of the information about the allergy
"lastOccurrence" : "<dateTime>", // Date(/time) of last known occurrence of a reaction
"note" : [{ Annotation }], // Additional text not captured in other fields
"reaction" : [{ // Adverse Reaction Events linked to exposure to substance
  "substance" : { CodeableConcept }, // Specific substance or pharmaceutical product considered to be responsible for event
  "manifestation" : [{ CodeableConcept }], // R! Clinical symptoms/signs associated with the Event
  "description" : "<string>", // Description of the event as a whole
  "onset" : "<dateTime>", // Date(/time) when manifestations showed
  "severity" : "<code>", // mild | moderate | severe (of event as a whole)
  "exposureRoute" : { CodeableConcept }, // How the subject was exposed to the substance
  "note" : [{ Annotation }] // Text about event not captured in other fields
}]
}
```

4.2.3 Terminology Bindings

Path	Definition	Type	Reference
AllergyIntolerance.clinicalStatus	The clinical status of the allergy or intolerance.	Required	AllergyIntoleranceClinicalStatusCodes
AllergyIntolerance.verificationStatus	Assertion about certainty associated with a propensity, or potential risk, of a reaction to the identified substance.	Required	AllergyIntoleranceVerificationStatusCodes

AllergyIntolerance.type	Identification of the underlying physiological mechanism for a Reaction Risk.	<u>Required</u>	AllergyIntoleranceType
AllergyIntolerance.category	Category of an identified substance associated with allergies or intolerances.	<u>Required</u>	AllergyIntoleranceCategory
AllergyIntolerance.criticality	Estimate of the potential clinical harm, or seriousness, of a reaction to an identified substance.	<u>Required</u>	AllergyIntoleranceCriticality
AllergyIntolerance.code	Type of the substance/product, allergy or intolerance condition, or negation/exclusion codes for reporting no known allergies.	<u>Example</u>	AllergyIntoleranceSubstance/Product,Condition AndNegationCodes

AllergyIntolerance.reaction.substance	Codes defining the type of the substance (including pharmaceutical products).	Example	SubstanceCode
AllergyIntolerance.reaction.manifestation	Clinical symptoms and/or signs that are observed or associated with an Adverse Reaction Event.	Example	SNOMEDCTClinicalFindings
AllergyIntolerance.reaction.severity	Clinical assessment of the severity of a reaction event as a whole, potentially considering multiple different manifestations.	Required	AllergyIntoleranceSeverity
AllergyIntolerance.reaction.exposureRoute	A coded concept describing	Example	SNOMEDCTRouteCodes

		the route or physiological path of administration of a therapeutic agent into or onto the body of a subject.		
--	--	--	--	--

4.2.4 Constraints

id	Level	Location	Description	Expression
ait	Rule	(base)	AllergyIntolerance.clinical Status SHALL be present if verificationStatus is not entered-in-error.	verificationStatus.coding.where(system = 'http://terminology.hl7.org/CodeSystem/allergyintolerance-verification' and code = 'entered-in-error').exists() or clinicalStatus.exists()
ait	Rule	(base)	AllergyIntolerance.clinical Status SHALL NOT be present if verification Status is entered-in-error	verificationStatus.coding.where(system = 'http://terminology.hl7.org/CodeSystem/allergyintolerance-verification' and code = 'entered-in-error').empty() or clinicalStatus.empty()

4.2.5 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, re-challenging).

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](#) 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).

Trial-Use 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](#) resource with emptyReason. The third available option is using the substanceExposureRisk extension. During the STU period, it is not recommended to use the [List](#) 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.

No Known Allergies, using [List](#).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>
</List>
```

```
<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.

4.2.6 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.

4.2.7 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "clinical-status",
    "type": "token"
  },
  {
    "name": "verification-status",
    "type": "token"
  },
  {
    "name": "type",
    "type": "token"
  },
  {
    "name": "criticality",
    "type": "token"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "_lastUpdated",
```

```
        "type": "date"
    },
    {
        "name": "asserter",
        "type": "reference"
    },
    {
        "name": "category",
        "type": "token"
    },
    {
        "name": "code",
        "type": "token"
    },
    {
        "name": "date",
        "type": "date"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "last-date",
        "type": "date"
    },
    {
        "name": "manifestation",
        "type": "token"
    },
    {
        "name": "onset",
        "type": "date"
    },
    {
        "name": "recorder",
        "type": "reference"
    },
    {
        "name": "route",
        "type": "token"
    },
    {
        "name": "severity",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common Name
asserter	reference	Source of the information about the allergy	AllergyIntolerance.asserter (Practitioner, Patient, PractitionerRole, RelatedPerson)	

category	token	food medication environment biologic	AllergyIntolerance.category	
clinical-status	token	active inactive resolved	AllergyIntolerance.clinicalStatus	
code	token	Code that identifies the allergy or intolerance	AllergyIntolerance.code AllergyIntolerance.reaction.substance	13 Resource S
criticality	token	low high unable-to- assess	AllergyIntolerance.criticality	
date	date	Date first version of the resource instance was recorded	AllergyIntolerance.recordedDate	17 Resource S
identifier	token	External ids for this item	AllergyIntolerance.identifier	30 Resource S
last-date	date	Date(/time) of last known occurrence of a reaction	AllergyIntolerance.lastOccurrence	
manifestation	token	Clinical symptoms/sign s associated with the Event	AllergyIntolerance.reaction.manifestation	

onset	date	Date(/time) when manifestations showed	AllergyIntolerance.reaction.onset	
patient	referenc e	Who the sensitivity is for	AllergyIntolerance.patient	33 Resource s
recorder	referenc e	Who recorded the sensitivity	AllergyIntolerance.recorder	(Practitioner, Patient, PractitionerRole, RelatedPerson)
route	token	How the subject was exposed to the substance	AllergyIntolerance.reaction.exposureRoute	
severity	token	mild moderate severe (of event as a whole)	AllergyIntolerance.reaction.severity	
type	token	allergy intolerance - Underlying mechanism (if known)	AllergyIntolerance.type	5 Resource s
verification- status	token	unconfirmed confirmed refuted entered-in- error	AllergyIntolerance.verificationStatus	

4.2.8 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/allergyintolerance-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/allergyintolerance-definitions.html
Mappings	http://hl7.org/fhir/R4/allergyintolerance-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/allergyintolerance-profiles.html

5 Appointment

Note: the following sections reference the FHIR standards version R4 -
<http://hl7.org/fhir/R4/appointment.html>

A booking of a healthcare event among patient(s), practitioner(s), related person(s) and/or device(s) for a specific date/time. This may result in one or more Encounter(s).

5.1 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 to 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 to ease exposure to other appointment / calendar standards widely used outside of healthcare.

5.1.1 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 and 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](#) resources associated with a selected [Schedule](#)) that can be booked against. Just because a time is indicated as 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 on the appointment 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.

- **Waitlisting the Appointment (optional)**

This optional step permits creating a waitlisted appointment. This could occur if an appointment needs to be booked into a time that is not ideal for the patient due to lack of available time slots. In this workflow, there would be two appointments, the booked appointment in the time slot that is currently available, and the waitlisted appointment with a requestedPeriod spanning the time that the patient would prefer if new slots become available.

If new time slots become available during the requestedPeriod, the scheduling system, or staff at the scheduling organization, can notify the patient that a new time slot is available. If the patient chooses, the waitlisted appointment would then be booked into that specific slot, and the previously booked appointment would be canceled. The specific business process for notifying patients of new availability is not specified, and is up to the implementing system to determine.

5.1.2 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.

Implementation Note: Note: This type of clinical appointment scheduling has not been specifically covered with this definition of the Appointment resource (and other 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.

5.2.1 Boundaries and Relationships

5.2.2 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 with 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.

5.2.3 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, the appointment Resource is probably not appropriate to be used. In these cases, an Encounter should be created.

The Appointment request pattern used is different from 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.

5.2.4 Appointment Locations and Participation

The location of the appointment is to be defined by using a participant that references a Location or HealthcareService resource.

This permits the location to also have its availability checked via a schedule and any conflicts more easily managed.

5.3 Resource Content

5.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

Name	Flags	Card.	Type	Description & Constraints 
 Appointment	 ITU		DomainResource	<p>A booking of a healthcare event among patient(s), practitioner(s), related person(s) and/or device(s) for a specific date/time. This may result in one or more Encounter(s)</p> <p>+ <i>Rule: Either start and end are specified, or neither</i></p> <p>+ <i>Rule: Only proposed or cancelled appointments can be missing start/end dates</i></p> <p>+ <i>Rule: Cancelation reason is only used for appointments that have been cancelled, or no-show</i></p> <p>Elements defined in</p> <p>Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
 Identifier	Σ	0..*	Identifier	External Ids for this item
 status	$?!\Sigma$	1..1	code	<p>proposed pending booked arrived fulfilled cancelled noshow entered-in-error checked-in waitlist</p> <p>AppointmentStatus (Required)</p>
 cancelationReason	Σ	0..1	CodeableConcept	<p>The coded reason for the appointment being cancelled</p> <p>Appointment cancellation reason (Example)</p>
 serviceCategory	Σ	0..*	CodeableConcept	<p>A broad categorization of the service that is to be performed during this appointment</p> <p>Service category (Example)</p>
 serviceType	Σ	0..*	CodeableConcept	<p>The specific service that is to be performed during this appointment</p> <p>Service type (Example)</p>

 specialty	Σ	0..*	CodeableConcept	The specialty of a practitioner that would be required to perform the service requested in this appointment Practice Setting Code Value Set (Preferred)
 appointment Type	Σ	0..1	CodeableConcept	The style of appointment or patient that has been booked in the slot (not service type) v2 Appointment Reason Codes (Preferred)
 reasonCode	Σ	0..*	CodeableConcept	Coded reason this appointment is scheduled Encounter Reason Codes (Preferred)
 reasonReference		0..*	Reference(Condition Procedure Observation ImmunizationRecommendation)	Reason the appointment is to take place (resource)
 priority		0..1	unsignedInt	Used to make informed decisions if needing to re-prioritize
 description		0..1	string	Shown on a subject line in a meeting request, or appointment list
 supportingInformation		0..*	Reference(Any)	Additional information to support the appointment
 start	Σ	0..1	instant	When appointment is to take place
 end	Σ	0..1	instant	When appointment is to conclude
 minutesDuration		0..1	positiveInt	Can be less than start/end (e.g. estimate)
 slot		0..*	Reference(Slot)	The slots that this appointment is filling
 created		0..1	dateTime	The date that this appointment was initially created
 comment		0..1	string	Additional comments

 patientInstruction	0..1	string	Detailed information and instructions for the patient
 basedOn	0..*	Reference(ServiceRequest)	The service request this appointment is allocated to assess
 participant	I	1..*	BackboneElement Participants involved in appointment + Rule: Either the type or actor on the participant SHALL be specified
 type	Σ	0..*	CodeableConcept Role of participant in the appointment Participant type (Extensible)
 actor	Σ	0..1	Reference(Patient Practitioner PractitionerRole RelatedPerson Device HealthcareService Location) Person, Location/HealthcareService or Device
 required	Σ	0..1	code required optional information-only ParticipantRequired (Required)
 status	Σ	1..1	code accepted declined tentative needs-action ParticipationStatus (Required)
 period		0..1	Period Participation period of the actor
 requestedPeriod		0..*	Period Potential date/time interval(s) requested to allocate the appointment within

5.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
    "type": "Appointment",  
    "profile": {  
        "reference": "http://www.hl7.org/fhir/appointment.html"  
    },  
    "interaction": [  
        {  
            "code": "read",  
            "documentation": "Read the current state of the resource"  
        },  
        {  
            "code": "create",  
            "documentation": "Create a new resource with a server assigned id"  
        },  
        {  
            "code": "update",  
            "documentation": "Update an existing resource by its id"  
        },  
        {  
            "code": "delete",  
            "documentation": "Delete a resource"  
        },  
        {  
            "code": "vread",  
            "documentation": "Read the state of a specific version of the resource"  
        },  
        {  
            "code": "patch"  
        },  
        {  
            "code": "history-instance",  
            "documentation": "Retrieve the change history for a particular resource."  
        },  
        {  
            "code": "history-type",  
            "documentation": "Retrieve the change history for all resources of a  
particular type"  
        },  
        {  
            "code": "search-type",  
            "documentation": "Search the resource type based on some filter criteria"  
        }  
    ]  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
?  
{  
    "resourceType" : "Appointment",  
    // from Resource: id, meta, implicitRules, and language  
    // from DomainResource: text, contained, extension, and modifierExtension  
    "identifier" : [{ Identifier }], // External Ids for this item  
    "status" : "<code>", // R! proposed | pending | booked | arrived | fulfilled | cancelled | noshow  
    // entered-in-error | checked-in | waitlist  
    "cancelationReason" : { CodeableConcept }, // The coded reason for the appointment being cancelled
```

```
"serviceCategory" : [{ CodeableConcept }], // A broad categorization of the service that is to be performed during this appointment
"serviceType" : [{ CodeableConcept }], // The specific service that is to be performed during this appointment
"specialty" : [{ CodeableConcept }], // The specialty of a practitioner that would be required to perform the service requested in this appointment
"appointmentType" : { CodeableConcept }, // The style of appointment or patient that has been booked in the slot (not service type)
"reasonCode" : [{ CodeableConcept }], // Coded reason this appointment is scheduled
"reasonReference" : [{ Reference(Condition|Procedure|Observation|ImmunizationRecommendation) }], // Reason the appointment is to take place (resource)
"priority" : "<unsignedInt>", // Used to make informed decisions if needing to re-prioritize
"description" : "<string>", // Shown on a subject line in a meeting request, or appointment list
"supportingInformation" : [{ Reference(Any) }], // Additional information to support the appointment
"start" : "<instant>", // When appointment is to take place
"end" : "<instant>", // When appointment is to conclude
"minutesDuration" : "<positiveInt>", // Can be less than start/end (e.g. estimate)
"slot" : [{ Reference(Slot) }], // The slots that this appointment is filling
"created" : "<dateTime>", // The date that this appointment was initially created
"comment" : "<string>", // Additional comments
"patientInstruction" : "<string>", // Detailed information and instructions for the patient
"basedOn" : [{ Reference(ServiceRequest) }], // The service request this appointment is allocated to assess
"participant" : [{ // R! Participants involved in appointment
  "type" : [{ CodeableConcept }], // Role of participant in the appointment
  "actor" : { Reference(Patient|Practitioner|PractitionerRole|RelatedPerson|Device|HealthcareService|Location) }, // Person, Location/HealthcareService or Device
  "required" : "<code>", // required | optional | information-only
  "status" : "<code>", // R! accepted | declined | tentative | needs-action
  "period" : { Period } // Participation period of the actor
}],
"requestedPeriod" : [{ Period }] // Potential date/time interval(s) requested to allocate the appointment within
}
```

5.3.3 Terminology Bindings

Path	Definition	Type	Reference
Appointment.status	The free/busy status of an appointment.	Required	AppointmentStatus
Appointment.cancelationReason		Example	AppointmentCancellationReason
Appointment.serviceCategory		Example	ServiceCategory
Appointment.serviceType		Example	ServiceType
Appointment.specialty		Preferred	PracticeSettingCodeValueSet
Appointment.appointmentType		Preferred	v2.0276
Appointment.reasonCode	The Reason for the appointment to take place.	Preferred	EncounterReasonCodes
Appointment.participant.type	Role of participant in encounter.	Extensible	ParticipantType
Appointment.participant.required	Is the Participant required to attend the appointment.	Required	ParticipantRequired
Appointment.participant.status	The Participation status of an appointment.	Required	ParticipationStatus

5.3.4 Constraints

id	Level	Location	Description	Expression
app-1	Rule	Appointment.participant	Either the type or actor on the participant	<code>type.exists() or actor.exists()</code>

			SHALL be specified	
app-2	<u>Rule</u>	(base)	Either start and end are specified, or neither	start.exists() = end.exists()
app-3	<u>Rule</u>	(base)	Only proposed or cancelled appointments can be missing start/end dates	(start.exists() and end.exists()) or (status in ('proposed' 'cancelled' 'waitlist'))
app-4	<u>Rule</u>	(base)	Cancelation reason is only used for appointments that have been cancelled, or no-show	Appointment.cancelationReason.exists() implies (Appointment.status='no-show' or Appointment.status='cancelled')

5.4.1 Typical Status Transition Examples:

5.4.2 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 – 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		
<i>Optional: Preparation for the appointment begins – could be preparing a room for the appointment, etc.</i> (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 (Role: Scheduler/Participant(s)/Admin)		status = fulfilled		status = in-progress

The encounter concludes (Role: Scheduler/Participant(s)/Admin)				status = finished
--	--	--	--	-------------------

5.4.3 Flow for the rejection/cancellation of an appointment

Activity Description	Slot	Appointment	Appointment Response
The schedule is created/published (Role: Scheduler)	freeBusyType = FREE		
An 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	

5.4.4 Flow for re-negotiation:

Activity Description	Slot	Appointment	Appointment Response
The schedule is created/published (Role: Scheduler)	freeBusyType = FREE		

An appointment is requested (e.g. 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 <i>(with new time)</i>
Appointment is updated with new time, and indicates that action is needed by both participants (Role: Scheduler)		<i>(new time details updated)</i> 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	

5.4.5 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)

5.4.6 Flow for a patient waitlist:

Activity Description	Appointment (inconvenient)	Appointment (preferred)
An appointment is booked for an inconvenient time using a typical status flow	status = booked participant.status = accepted	
Waitlist appointment created	status = booked participant.status = accepted	status = waitlist requestedPeriod = (more convenient time period)

Patient notified of availability of a better slot	status = booked	status = proposed participant.status = needs-action
Patient accepts better slot	status = cancelled	status = booked participant.status = accepted

5.4.7 Notes:

- **Placer/Filler ([HL7 v2](#))**
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.
- **Terminology - ServiceCategory, ServiceType and Specialty**
The 3 core clinical terminologies associated with the appointment may have relationships with each other through the terminology server, but not these might not be visible in the actual appointment resource or profile.
- **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>.

Trial-Use Note: Implementer feedback 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.

Implementer feedback is also sought to clarify desired relationship linkages between ServiceCategory, ServiceType and Specialty, along with how they have approached the definition.

Feedback [here](#).

5.4.8 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "actor",  
        "type": "reference"  
    },  
    {  
        "name": "appointment-type",  
        "type": "token"  
    },  
    {  
        "name": "based-on",  
        "type": "reference"  
    },  
    {  
        "name": "date",  
        "type": "date"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    },  
    {  
        "name": "location",  
        "type": "reference"  
    },  
    {  
        "name": "part-status",  
        "type": "token"  
    },  
    {  
        "name": "patient",  
        "type": "reference"  
    },  
    {  
        "name": "practitioner",  
        "type": "reference"  
    },  
    {  
        "name": "reason-code",  
        "type": "token"  
    },  
    {  
        "name": "reason-reference",  
        "type": "reference"  
    },  
    {  
        "name": "service-category",  
        "type": "token"  
    },  
    {  
        "name": "service-type",  
        "type": "token"  
    },  
    {  
        "name": "slot",  
        "type": "reference"  
    },  
    {
```

```
        "name": "specialty",
        "type": "token"
    },
    {
        "name": "status",
        "type": "token"
    },
    {
        "name": "supporting-info",
        "type": "reference"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
actor	reference	Any one of the individuals participating in the appointment	Appointment.participant.actor (Practitioner , Device , Patient , HealthcareService , PractitionerRole , RelatedPerson , Location)	
appointment -type	token	The style of appointment or patient that has been booked in the slot (not service type)	Appointment.appointmentType	
based-on	reference	The service request this appointment is allocated to assess	Appointment.basedOn (ServiceRequest)	
date	date	Appointment date/time.	Appointment.start	

identifier [token](#) An Identifier Appointment.identifier
of the
Appointment

location [referenc](#) This location Appointment.participant.actor.w
e is listed in the here(resolve() is Location)
participants ([Location](#))
of the
appointment

part-status [token](#) The Appointment.participant.status
Participation
status of the
subject, or
other
participant on
the
appointment.
Can be used
to locate
participants
that have not
responded to
meeting
requests.

patient [referenc](#) One of the Appointment.participant.actor.w
e individuals of here(resolve() is Patient)
the ([Patient](#))
appointment
is this patient

practitioner [referenc](#) One of the Appointment.participant.actor.w
e individuals of here(resolve() is Practitioner)
the ([Practitioner](#))
appointment

is this
practitioner

reason-code [token](#) Coded reason Appointment.reasonCode
this
appointment
is scheduled

reason-
reference [referenc](#)e Reason the Appointment.reasonReference
appointment ([Condition](#), [Observation](#), [Proced](#)
is to take [ure](#), [ImmunizationRecommenda](#)
place [tion](#))
(resource)

service-
category [token](#) A broad Appointment.serviceCategory
categorizatio
n of the
service that is
to be
performed
during this
appointment

service-type [token](#) The specific Appointment.serviceType
service that is
to be
performed
during this
appointment

slot [referenc](#)e The slots that Appointment.slot
this ([Slot](#))
appointment
is filling

specialty [token](#) The specialty Appointment.specialty
of a

practitioner
that would be
required to
perform the
service
requested in
this
appointment

status	token	The overall status of the appointment	Appointment.status
--------	-----------------------	---------------------------------------	--------------------

supporting- info	reference	Additional information to support the appointment	Appointment.supportingInformation (Any)
---------------------	---------------------------	---	--

5.4.9 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/appointment-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/appointment-definitions.html
Mappings	http://hl7.org/fhir/R4/appointment-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/appointment-profiles.html

6 Charge Item

Note: the following sections reference the FHIR standards version R4 –
<http://hl7.org/fhir/R4/chargeitem.html>

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.

6.1 Scope and Usage

Tracking Financial information is vital in Patient Administration and Finance systems in most Healthcare Organizations. The resource ChargeItem describes the charge for 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 have 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 responsibility 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 to 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 to create financial transactions according to base price and factors. Additional references to Encounter/EpisodeOfCare, Patient/Group and Services provide further context to help billing systems determine the appropriate account and establish the clinical/financial context to evaluate the rules associated with the charge codes.

6.1.2 Boundaries and Relationships

This resource is not an actual financial transaction (such as an item on an invoice or any concise monetary amount 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).

6.2 Resource Content

6.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

<u>Name</u>	<u>Flags</u>	<u>Card.</u>	<u>Type</u>
 Charge Item	TU		DomainResource
  identifier	Σ	0..*	Identifier
  definitionUri		0..*	uri
  definitionCanonical		0..*	canonical(ChargeItemDefinition)
  status	$?!\Sigma$	1..1	code
  code	Σ	1..1	CodeableConcept
  occurrence[x]	Σ	0..1	

	occurrenceDateTime			dateTime
	occurrencePeriod			Period
	occurrenceTiming			Timing
	function	0..1		CodeableConcept
	actor	1..1		Reference(Practitioner PractitionerRole Organization CareTeam Patient)
	performingOrganization	0..1		Reference(Organization)
	requestingOrganization	0..1		Reference(Organization)
	costCenter	0..1		Reference(Organization)
	quantity	Σ	0..1	Quantity
	bodysite	Σ	0..*	CodeableConcept
	factorOverride	0..1		decimal
	priceOverride	0..1		Money
	overrideReason	0..1		string
	service	0..*		Reference(DiagnosticReport ImagingStudy Immunization MedicationAdministration Procedure)
	note	0..*		Annotation

6.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
  "type": "ChargeItem",  
  "profile": {  
    "reference": "http://hl7.org/fhir/R4/chargeitem.html"  
  },  
  "interaction": [  
    {  
      "code": "read",  
      "documentation": "Read the current state of the resource"  
    },  
    {  
      "code": "create",  
      "documentation": "Create a new resource with a server assigned id"  
    }  
  ]  
}
```

```
},
{
  "code": "update",
  "documentation": "Update an existing resource by its id"
},
{
  "code": "delete",
  "documentation": "Delete a resource"
},
{
  "code": "vread",
  "documentation": "Read the state of a specific version of the resource"
},
{
  "code": "patch"
},
{
  "code": "history-instance",
  "documentation": "Retrieve the change history for a particular resource."
},
{
  "code": "history-type",
  "documentation": "Retrieve the change history for all resources of a
particular type"
},
{
  "code": "search-type",
  "documentation": "Search the resource type based on some filter criteria"
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?
  "resourceType" : "ChargeItem",
  // from Resource: id, meta, implicitRules, and language
  // from DomainResource: text, contained, extension, and modifierExtension
  "identifier" : [{ Identifier }], // Business Identifier for item
  "definitionUri" : ["<uri>"], // Defining information about the code of this charge item
  "definitionCanonical" : [{ canonical(ChargeItemDefinition) }], // Resource defining the code of this ChargeItem
  "status" : "<code>", // R! planned | billable | not-billable | aborted | billed | entered-in-error | unknown
  "partOf" : [{ Reference(ChargeItem) }], // Part of referenced ChargeItem
  "code" : { CodeableConcept }, // R! A code that identifies the charge, like a billing code
  "subject" : { Reference(Patient|Group) }, // R! Individual service was done for/to
  "context" : { Reference(Encounter|EpisodeOfCare) }, // Encounter / Episode associated with event
  // occurrence[x]: When the charged service was applied. One of these 3:
  "occurrenceDateTime" : "<dateTime>",
  "occurrencePeriod" : "<period>",
  "occurrenceTiming" : "<timing>"
}
```

```
"occurrencePeriod" : { Period },  
"occurrenceTiming" : { Timing },  
"performer" : [{ // Who performed charged service  
  "function" : { CodeableConcept }, // What type of performance was done  
  "actor" : { Reference(Practitioner|PractitionerRole|Organization|CareTeam|Patient|Device|RelatedPerson) } // R! Individual who was performing"performingOrganization" : { Reference(Organization) }, // Organization providing the charged service  
"requestingOrganization" : { Reference(Organization) }, // Organization requesting the charged service  
"costCenter" : { Reference(Organization) }, // Organization that has ownership of the (potential, future) revenue  
"quantity" : { Quantity }, // Quantity of which the charge item has been serviced  
"bodySite" : [{ CodeableConcept }], // Anatomical location, if relevant  
"factorOverride" : <decimal>, // Factor overriding the associated rules  
"priceOverride" : { Money }, // Price overriding the associated rules  
"overrideReason" : "<string>", // Reason for overriding the list price/factor  
"enterer" : { Reference(Practitioner|PractitionerRole|Organization|Patient|Device|RelatedPerson) }, // Individual who was entering  
"enteredDate" : "<dateTime>", // Date the charge item was entered  
"reason" : [{ CodeableConcept }], // Why was the charged service rendered?  
"service" : [{ Reference(DiagnosticReport|ImagingStudy|Immunization|MedicationAdministration|MedicationDispense|Observation|Procedure|SupplyDelivery) }], // Which rendered service is being charged?  
// product[x]: Product charged. One of these 2:  
"productReference" : { Reference(Device|Medication|Substance) },  
"productCodeableConcept" : { CodeableConcept },  
"account" : [{ Reference(Account) }], // Account to place this charge  
"note" : [{ Annotation }], // Comments made about the ChargeItem  
"supportingInformation" : [{ Reference(Any) }] // Further information supporting this charge  
}
```

6.2.3 Terminology Bindings

Path	Definition	Type	Reference
------	------------	------	-----------

ChargeItem.status	Codes identifying the lifecycle stage of a ChargeItem.	Required	ChargeItemStatus
ChargeItem.code	Example set of codes that can be used for billing purposes.	Example	ChargeItemCode
ChargeItem.performer.function	Codes describing the types of functional roles performers can take on when performing events.	Example	ProcedurePerformerRoleCodes
ChargeItem.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMEDCTBodyStructures
ChargeItem.reason	Example binding for reason.	Example	ICD-10Codes
ChargeItem.product[x]	Example binding for product type.	Example	FHIRDeviceTypes

6.2.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "contact",
    "type": "token"
  },
  {
    "name": "criteria",
    "type": "string"
  },
  {
    "name": "payload",
    "type": "token"
  },
  {
    "name": "status",
    "type": "token"
  },
  {
    "name": "type",
    "type": "token"
  },
  {
    "name": "url",
    "type": "token"
  }
]
```

```
        "type": "url"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
code	token	A code that identifies the charge, like a billing code	ChargeItem.code	
patient	reference	Individual service was done for/to	ChargeItem.subject.where(r esolve() is Patient)	

6.2.5 Additional Information

Category	Link
Examples	http://hl7.org/fhir/R4/chargeitem-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/chargeitem-definitions.html
Mappings	http://hl7.org/fhir/R4/chargeitem-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/chargeitem-profiles.html

7 Code System

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/codesystem.html>

The CodeSystem resource is used to declare the existence of and describe a code system or code system supplement and its key properties, and optionally define a part or all of its content.

7.1 Scope and Usage

The FHIR terminology specification is based on two key concepts, originally defined in [HL7 v3 Core Principles](#):

- **code system** - declares the existence of and describes a code system or code system supplement and its key properties, and optionally defines a part or all of its content. Also known as Ontology, Terminology, or Enumeration
- **value set** - specifies a set of codes drawn from one or more code systems, intended for use in a particular context. Value sets link between **CodeSystem** definitions and their use in [coded elements](#)

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 its key properties:

- Identifying URL and version
- Description, Copyright, publication date, and other metadata
- Some key properties of the code system itself - e.g. whether it exhibits concept permanence, whether it defines a compositional grammar, and whether the codes that it defines are case sensitive
- What filters can be used in value sets that use the code system in a ValueSet.compose element
- What concept properties are 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. Code System resources may also be used to define supplements, which extend an existing code system with additional designations and properties.

The CodeSystem resource is not intended to support the process of maintaining code systems. 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 maintenance systems and distribution formats, and CodeSystem is generally not an efficient way to distribute their content, though it is used as one way of declaring the filters and properties associated with those code systems.

7.1.1 Boundaries and Relationships

- Code systems are used in [ValueSet](#) resources
- The [Coding](#) data type refers to CodeSystem resources by their canonical URL
- The CodeSystem resource design is based, in part, on the code system functionality described in the [HL7 CTS 2](#) specification. A CTS2 server can be used to maintain code systems which are then published using the CodeSystem resource
- The CodeSystem resource documents the inherent structure and capabilities of code system, whereas the [TerminologyCapabilities](#) resource documents what a server hosting the code system is capable of

The [CodeSystem](#) resource declares the existence of a code system and its key properties including its 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 or publisher of the code system, who can properly define the code system features and content. [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 system, but ideally there would be only one authoritative [CodeSystem](#) resource (identified by its canonical URL) that is provided by the code system publisher, with multiple copies distributed on additional FHIR servers or elsewhere and used where needed.

Both Code System supplements and [Concept Maps](#) may be used to define relationships between concepts in different systems. ConceptMaps are assertions of the relationships between different concepts that are associated with particular contexts of use, while CodeSystem supplements are used to define inherent properties and semantics of the concepts in the code system

7.2 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](#).

7.2.1 CodeSystem Identification

A code system has three identifiers. The first two can be used to reference the code system in the FHIR context:

- **CodeSystem.id**: The [logical id](#) on the system that holds the CodeSystem resource instance - this typically is expected to change as the resource moves from server to server. The location URI is constructed by appending the logical id to the server base address where the instance is found and the resource type. This URI should be a resolvable URL by which the resource instance may be retrieved, usually from a FHIR server, and it may be a relative reference typically to the server base URL.
- **CodeSystem.url**: The canonical URL that never changes for this code system - it is the same in every copy. The element is named [url](#) rather than [uri](#) for legacy reasons and to strongly encourage providing a resolvable URL as the identifier whenever possible. This canonical URL is used to refer to all instances of this particular code system across all servers and systems. Ideally, this URI should be a URL which resolves to 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 the FHIR specification all have a location ("literal") URI which is the URL where 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 version.

Because it is common practice to copy (cache) code systems locally, most references to code systems can use either the canonical URL or the location ("literal") URL.

The third code system identifier is used typically for external references to the code system outside of FHIR:

- **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](#) specification)

For further information regarding resource identification, see [Resource Identity](#).

This means that each code system has 2 different URIs that can be used to reference it - its canonical URL (the [url](#) element), and its local location from which it may be retrieved (which includes the [id](#) element). Because it is common practice to copy (cache) code systems locally, most references to code systems use the canonical URL.

Alternatively, the [identifier](#) and [version](#) elements may be used to reference this code system in a design, a profile, a [CDA](#) template or [HL7 v3](#) 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.

7.3 Resource Content

7.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 CodeSystem			DomainResource	<p>Declares the existence of and describes a code system or code system supplement</p> <p>+ <i>Warning: Name should be usable as an identifier for the module by machine processing applications such as code generation tools.</i></p> <p>+ <i>Rule: Within a code system definition, all the codes SHALL be unique</i></p> <p>Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
  url		0..1	uri	Canonical identifier for this code system, represented as a URI (globally unique) (Coding.system)
  identifier		0..*	Identifier	Additional identifier for the code system (business identifier)
  version		0..1	string	Business version of the code system (Coding.version)
  name		0..1	string	Name for this code system (computer friendly)
  title		0..1	string	Name for this code system (human friendly)
  status		1..1	code	draft active retired unknown PublicationStatus (Required)
  experimental		0..1	boolean	For testing purposes, not real usage
  date		0..1	dateTime	Date last changed
  publisher		0..1	string	Name of the publisher (organization or individual)
  contact		0..*	ContactDetail	Contact details for the publisher
  description		0..1	markdown	Natural language description of the code system
  useContext		0..*	UsageContext	The context that the content is intended to support
  jurisdiction		0..*	CodeableConcept	Intended jurisdiction for code system (if applicable) Jurisdiction (Extensible)

 purpose		0..1	markdown	Why this code system is defined
 copyright		0..1	markdown	Use and/or publishing restrictions
 caseSensitive	Σ	0..1	boolean	If code comparison is case sensitive
 valueSet	Σ	0..1	canonical(ValueSet)	Canonical reference to the value set with entire code system
 hierarchyMeaning	Σ	0..1	code	grouped-by is-a part-of classified-with CodeSystemHierarchyMeaning (Required)
 compositionality	Σ	0..1	boolean	If code system defines a compositional grammar
 versionNeed	Σ	0..1	boolean	If definitions are not stable
 content	Σ	1..1	code	not-present example fragment complete supplement CodeSystemContentMode (Required)
 count	Σ	0..1	unsignedInt	Total concepts in the code system
 filter	Σ	0..*	BackboneElement	Filter that can be used in a value set
 code	Σ	1..1	code	Code that identifies the filter
 description	Σ	0..1	string	How or why the filter is used
 operator	Σ	1..*	code	= is-a descendent-of is-not-a regex in not-in generalizes exists FilterOperator (Required)
 value	Σ	1..1	string	What to use for the value
 property	Σ	0..*	BackboneElement	Additional information supplied about each concept

	 code	Σ	1..1	code	Identifies the property on the concepts, and when referred to in operations
	 uri	Σ	0..1	uri	Formal identifier for the property
		Σ	0..1	string	Why the property is defined, and/or what it conveys
	 description				
	 type	Σ	1..1	code	code Coding string integer boolean dateTIme decimal PropertyType (Required)
	 concept		0..*	BackboneElement	Concepts in the code system
	 code		1..1	code	Code that identifies concept
	 display		0..1	string	Text to display to the user
			0..1	string	Formal definition
	 definition				
	 designation		0..*	BackboneElement	Additional representations for the concept
	 language		0..1	code	Human language of the designation Common Languages (Preferred but limited to AllLanguages)
	 use		0..1	Coding	Details how this designation would be used Designation Use (Extensible)
	 value		1..1	string	The text value for this designation
	 property		0..*	BackboneElement	Property value for the concept
	 code		1..1	code	Reference to CodeSystem.property.code
	 value[x]		1..1		Value of the property for this concept
	 valueCode			code	

			<u>Coding</u>	
			<u>string</u>	
			<u>integer</u>	
			<u>boolean</u>	
			<u>dateTime</u>	
			<u>decimal</u>	
		0..*	see <u>concept</u>	Child Concepts (is-a/contains/categorizes)

7.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "CodeSystem",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/codesystem.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "vread"
    }
  ]
}
```

```
},
{
  "code": "history-type"
},
{
  "code": "history-instance"
},
{
  "code": "patch"
},
{
  "code": "search-type"
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "CodeSystem",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "url" : "<uri>", // Canonical identifier for this code system, represented as a URI (globally unique) (Coding.system)  
  "identifier" : [{ Identifier }], // Additional identifier for the code system (business identifier  
  "version" : "<string>", // Business version of the code system (Coding.version)  
  "name" : "<string>", // C? Name for this code system (computer friendly)  
  "title" : "<string>", // Name for this code system (human friendly)  
  "status" : "<code>", // R! draft | active | retired | unknown  
  "experimental" : <boolean>, // For testing purposes, not real usage  
  "date" : "<dateTime>", // Date last changed  
  "publisher" : "<string>", // Name of the publisher (organization or individual)  
  "contact" : [{ ContactDetail }], // Contact details for the publisher  
  "description" : "<markdown>", // Natural language description of the code system  
  "useContext" : [{ UsageContext }], // The context that the content is intended to support  
  "jurisdiction" : [{ CodeableConcept }], // Intended jurisdiction for code system (if applicable)  
  "purpose" : "<markdown>", // Why this code system is defined  
  "copyright" : "<markdown>", // Use and/or publishing restrictions  
  "caseSensitive" : <boolean>, // If code comparison is case sensitive  
  "valueSet" : { canonical(ValueSet) }, // Canonical reference to the value set with entire code system
```

```
"hierarchyMeaning" : "<code>", // grouped-by | is-a | part-of | classified-with
"compositional" : <boolean>, // If code system defines a compositional grammar
"versionNeeded" : <boolean>, // If definitions are not stable
"content" : "<code>", // R! not-present | example | fragment | complete | supplement
"supplements" : { canonical(CodeSystem) }, // Canonical URL of Code System this adds designations and properties to
"count" : "<unsignedInt>", // Total concepts in the code system
"filter" : [{ // Filter that can be used in a value set
  "code" : "<code>", // R! Code that identifies the filter
  "description" : "<string>", // How or why the filter is used
  "operator" : ["<code>"], // R! = | is-a | descendant-of | is-not-a | regex | in | not-in | generalizes | exists
  "value" : "<string>" // R! What to use for the value
}],
"property" : [{ // Additional information supplied about each concept
  "code" : "<code>", // R! Identifies the property on the concepts, and when referred to in operations
  "uri" : "<uri>", // Formal identifier for the property
  "description" : "<string>", // Why the property is defined, and/or what it conveys
  "type" : "<code>" // R! code | Coding | string | integer | boolean | date | date-time | decimal
}],
"concept" : [{ // Concepts in the code system
  "code" : "<code>", // R! Code that identifies concept
  "display" : "<string>", // Text to display to the user
  "definition" : "<string>", // Formal definition
  "designation" : [{ // Additional representations for the concept
    "language" : "<code>", // Human language of the designation
    "use" : { Coding }, // Details how this designation would be used
    "value" : "<string>" // R! The text value for this designation
  }],
  "property" : [{ // Property value for the concept
    "code" : "<code>", // R! Reference to CodeSystem.property.code
    // value[x]: Value of the property for this concept. One of these 7:
    "valueCode" : "<code>",
    "valueCoding" : { Coding }
    "valueString" : "<string>"
  }]
}]
```

```
  "valueInteger" : <integer>
  "valueBoolean" : <boolean>
  "valueDateTime" : "<dateTime>"
  "valueDecimal" : <decimal>
],
  "concept" : [{ Content as for CodeSystem.concept }] // Child Concepts (is-a/contains/categorizes
)
}
}
```

7.3.3 Terminology Bindings

Path	Definition	Type	Reference
CodeSystem.status	The lifecycle status of an artifact.	Required	PublicationStatus
CodeSystem.jurisdiction	Countries and regions within which this artifact is targeted for use.	Extensible	Jurisdiction ValueSet
CodeSystem.hierarchyMeaning	The meaning of the hierarchy of concepts in a code system.	Required	CodeSystemHierarchyMeaning
CodeSystem.content	The extent of the content of	Required	CodeSystemContentMode

	the code system (the concepts and codes it defines) are represented in a code system resource.		
CodeSystem.filter.operator	The kind of operation to perform as a part of a property based filter.	Required	FilterOperator
CodeSystem.property.type	The type of a property value.	Required	.PropertyType
CodeSystem.concept.designation.language	A human language.	Preferred , but limited to AllLanguages	CommonLanguages
CodeSystem.concept.designation.use	Details of how a designation would be used.	Extensible	DesignationUse

7.3.4 Constraints

id	Level	Location	Description	Expression
csd-0	Warning	(base)	Name should be usable as an identifier for the module by machine processing applications such as code generation	name.matches(' [A-Z] ([A-Za-z0-9_]) {0,254} ')
csd-1	Rule	(base)	Within a code system definition, all the codes SHALL be unique	concept.code.combine(\$this.descendants().concept.code).isDistinct()

7.3.5 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](#) 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](#) 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.

7.3.6 Multi-part Code Systems

The simple case for a code system is that the entire code system - all the concepts and their codes, designations and properties are distributed in a single `CodeSystem` resource. However, for a variety of reasons, code systems may be distributed by the code system authority in a set of fragments, and other authorities may issue additional designations and properties in supplements.

7.3.7 Code System Fragments

If the `CodeSystem.content` value is `fragment`, then the resource describes part of a code system.

Code Systems may be distributed in fragments for the following reasons:

- Different IP distribution rules for different parts of the code system
- Special purpose modules for specific purposes
- Distribution of proposed content for evaluation

The following rules apply to code system fragments:

- All fragments SHALL have the same `CodeSystem.url`
- Fragments can only be published by the code system authority, or according to a process defined by the authority, if they have defined one
- Fragments cannot contain any codes, concepts or properties that would not be found in a complete representation of the code system, if one exists
- Publishing a code system in multiple fragments can create confusion for terminology servers and terminology service consumers. Code System authorities that publish fragments should be careful and communicate their intent clearly

7.3.8 Code System Supplements

If the `CodeSystem.content` value is `supplement`, then the resource describes a code system supplement.

The following rules apply to code system supplements:

- The `CodeSystem.supplements` element SHALL have a value, which is the URL of the code system being supplemented
- The `CodeSystem.url` for a supplement SHALL never appear in a [Coding.system](#)
- The `CodeSystem.url` for a supplement must be under the control of the authority creating or publishing the supplement (e.g. not in the same space as the code system being supplemented, unless the supplement is being issued by the same authority as the original code system)
- A codesystem supplement cannot define any new `CodeSystem.concept.code`. i.e.: all `CodeSystem.concept.code` in the supplement must be a code from the "supplemented" code system

If a supplement needs to define new concepts/codes to use as property values, it can be paired with a new (possibly contained) Code System and use the [Coding](#) type for the property values.

7.3.9 Display, Definition and Designations

Concepts have both a `display` and a `definition`. The display is a short text that represents the meaning of the concept to human users, while the definition is a more formal statement of the meaning of the concept, which is often longer. All concepts SHOULD have a `display` and a `definition`, though it is not mandatory because there are many cases where no such properties are provided, in spite of their utility and importance for clear and safe communication.

In addition to the display and definition, a concept can have one or more `designation` elements. The display is equivalent to a special designation with an implied `designation.use` meaning "primary code/designation" and a language equal to the [Resource Language](#). The designations can provide additional displays for other language, as well as designations for other purposes. When using concepts, applications use the `display` and `designation` unless the language or usage in context provides a reason to use one of the designations.

7.3.10 Properties

Each code system can define one or more concept properties. Each concept defined by the code system may have one or more values for each concept 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](#): `ConceptMap.element.target.dependsOn.property` and `ConceptMap.element.target.product.property`
- [ValueSet](#): `ValueSet.compose.include.filter.property` can refer to any defined code system property
- [\\$lookup operation](#): In `Parameters.parameter.name` when returning information about a code
- [\\$translate operation](#): In `Parameters.parameter.part.name` for dependencies and products
- [\\$find-matches operation](#): 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	Used to identify the property, in the places shown in the list immediately above this table
uri	optional uri	Reference to the formal meaning of the property. One possible source of meaning is the Concept Properties code system. This part of the definition is optional, but is recommended to provide an additional level of definitional consistency
description	optional string	A description of the property- why it is defined, and how its 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 another 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.

7.3.11 Concept Status

Many Code Systems have a 'status' associated with the concept. This may categorize 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 also be labeled 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:

<code>http://hl7.org/fhir/concept-properties#status : code</code>	<p>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):</p> <ul style="list-style-type: none">• active - the concept is for normal use• 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 <p>The HL7 defined code systems (whether defined by the FHIR project, the V3 framework, or the V2 standard) all use this property to define their status. HL7 uses "active" (and considers this the default status), and deprecated and retired (= inactive)</p>
---	---

http://hl7.org/fhir/concept-properties#retirementDate : date	Date Concept was retired
http://hl7.org/fhir/concept-properties#deprecationDate : date	Date Concept was deprecated
http://hl7.org/fhir/concept-properties#parent : code	An immediate parent of the concept in the hierarchy
http://hl7.org/fhir/concept-properties#child : code	An immediate child of the concept in the hierarchy
http://hl7.org/fhir/concept-properties#notSelectable : boolean	This concept is a grouping concept and not intended to be used in the normal use of the code system (though may be used for filters etc.). This is also known as 'Abstract'

The parent and child properties are used when performing concept lookup (using the [\\$lookup](#) operation), and when using properties to indicate parent/child relationships (see below).

7.3.12 Concept Hierarchy

Code systems may be presented hierarchically, using nested `concept` elements, where the hierarchy has a defined meaning specified in `hierarchyMeaning`. The code system hierarchy is a single tree, where concepts have only one parent.

Some code systems define concepts that have multiple parents. If a code system has concepts like this (typically, concepts that are subsumed by more than one other concept), the code system **SHOULD NOT** be represented using the hierarchy structure in the Code System resource, and the relationships between concepts should be defined using [properties](#). If the hierarchy is used, implementers **SHALL** use a property to indicate additional parents that are not represented in the structural (nested concepts) hierarchy.

Operations based on the `codeSystem` resource **SHALL** have the same result whether or not the relationships are represented explicitly as properties or implicitly using the `CodeSystem` resource hierarchy.

7.3.13 Subsumption Testing

The words 'subsume', 'subsumes', 'subsumed' and 'subsumption' are defined in relation to the type of hierarchy (i.e. the value of [CodeSystem.hierarchyMeaning](#)) identified for the code system that is being represented by the `CodeSystem` resource. Concept A is considered to be subsumed by Concept B if it

comes under Concept B in the hierarchy, or if a parent/child relationship is declared in the properties, and the hierarchyMeaning is "is-a").

Where a CodeSystem does not declare its hierarchy meaning directly, then the code system documentation must be consulted manually to determine 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](#)
- [CodeSystem \\$lookup operation](#)
- [ConceptMap \\$closure operation](#)
- [Search by subsumption](#)
- [ValueSet \\$expand operation](#)
- [ValueSet \\$validate-code operation](#)

7.3.14 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	
[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	The values cannot include ",", since it is being used as a delimiter

This **[draft section](#)** about the relationships between rich terminologies and structured content is still undergoing review.

7.3.15 Implicit Code Systems

Some other parts of the FHIR infrastructure define set of concepts that may also be treated as code systems. This is most useful when mapping between systems using [Concept Maps](#), but might also be useful for other code system related functionality (e.g. subsetting use [Value Sets](#)). This table summarizes how to treat these items as a terminology:

StructureDefinition	The <code>StructureDefinition.url</code> (canonical URL) is the <code>system</code> . Each <code>.snapshot.element.id</code> in the snapshot is a code in the code system
Questionnaire	The <code>Questionnaire.url</code> (canonical URL) is the <code>system</code> . Each <code>.item.linkId</code> in the snapshot is a code in the code system. Items with no linkId 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 of the resource is the code

The use of these implicit code systems is not yet well tested, so this section remains informative.

For medications, the relationship between the code system and the medication resource is complex. Many medication related code systems (e.g. RxNorm, DM+D, AMT, etc.) represent more complex information than just code, display name and code system. These often contain information about the content of the medication. A similar principle applies to observation definitions, which overlap significantly with LOINC and other related code systems, which contain a set of observation definitions, that contain methods, units, etc. Other similar arrangements exist for [Location](#) and many other kinds of resource.

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 resource instances](#) for RxNorm code details, [ObservationDefinition](#) instances for LOINC code details, or [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. .

7.3.16 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "code",  
        "type": "token"  
    },  
    {  
        "name": "content-mode",  
        "type": "token"  
    },  
    {  
        "name": "context",  
        "type": "token"  
    },  
    {  
        "name": "context-quantity",  
        "type": "quantity"  
    },  
    {  
        "name": "context-type",  
        "type": "token"  
    },  
    {  
        "name": "context-type-quantity",  
        "type": "composite"  
    },
```

```
{  
  "name": "context-type-value",  
  "type": "composite"  
},  
{  
  "name": "date",  
  "type": "date"  
},  
{  
  "name": "description",  
  "type": "string"  
},  
{  
  "name": "identifier",  
  "type": "token"  
},  
{  
  "name": "jurisdiction",  
  "type": "token"  
},  
{  
  "name": "language",  
  "type": "token"  
},  
{  
  "name": "name",  
  "type": "string"  
},  
{  
  "name": "publisher",  
  "type": "string"  
},  
{  
  "name": "status",  
  "type": "token"  
},  
{  
  "name": "supplements",  
  "type": "reference"  
},  
{  
  "name": "system",  
  "type": "uri"  
},  
{  
  "name": "title",  
  "type": "string"  
},  
{  
  "name": "url",  
  "type": "uri"  
},  
{  
  "name": "version",  
  "type": "token"  
}  
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
code TU	token	A code defined in the code system	CodeSystem.concept.code	
content-mode TU	token	not-present example fragment complete supplement	CodeSystem.content	
context TU	token	A use context assigned to the code system	(CodeSystem.useContext.value as CodeableConcept)	
context-quantity TU	quantity	A quantity- or range-valued use context assigned to the code system	(CodeSystem.useContext.value as Quantity) (CodeSystem.useContext.value as Range)	
context-type TU	token	A type of use context assigned to the code system	CodeSystem.useContext.code	
context-type-quantity TU	composite	A use context type and quantity- or range-based value assigned to the code system	On CodeSystem.useContext: context-type: code context-quantity: value.as(Quantity) value.as(Range)	

context-type-value	TU	composite	A use context type and value assigned to the code system	On CodeSystem.useContext: context-type: code context: value.as(CodeableConcept)
date	TU	date	The code system publication date	CodeSystem.date
description	TU	string	The description of the code system	CodeSystem.description
identifier	TU	token	External identifier for the code system	CodeSystem.identifier
jurisdiction	TU	token	Intended jurisdiction for the code system	CodeSystem.jurisdiction
language	TU	token	A language in which a designation is provided	CodeSystem.concept.designation.language
name	TU	string	Computationally friendly name of the code system	CodeSystem.name
publisher	TU	string	Name of the publisher of the code system	CodeSystem.publisher

status TU	token	The current status of the code system	CodeSystem.status
supplements TU	reference	Find code system supplements for the referenced code system	CodeSystem.supplements (CodeSystem)
system TU	uri	The system for any codes defined by this code system (same as 'url')	CodeSystem.url
title TU	string	The human-friendly name of the code system	CodeSystem.title
url TU	uri	The uri that identifies the code system	CodeSystem.url
version TU	token	The business version of the code system	CodeSystem.version

7.3.17 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/codesystem-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/codesystem-definitions.html
Mappings	http://hl7.org/fhir/R4/codesystem-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/codesystem-profiles.html
Operations	http://hl7.org/fhir/R4/codesystem-operations.html

8 Condition

Note: the following sections reference the FHIR standards version R4 -
<https://www.hl7.org/fhir/condition.html>

A clinical condition, problem, diagnosis, or other event, situation, issue, or clinical concept that has risen to a level of concern.

8.1 Scope and Usage

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 practitioner's Problem List, or it could be a concern that doesn't exist on the practitioner's Problem List. Oftentimes, 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 practitioner'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 patient's health:

- 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

These examples may also be represented using other resources, such as [FamilyMemberHistory](#), [Observation](#), [RiskAssessment](#), or [Procedure](#).

8.1.1 Boundaries and Relationships

The condition resource may be referenced by other resources as "reasons" for an action (e.g. [MedicationRequest](#), [Procedure](#), [ServiceRequest](#), 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](#) 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. In an inpatient scenario, a nursing problem list may document symptoms (such as respiratory alteration) as conditions if they are the focus of care provision. It became a problem because the nurse (clinician) wants to manage it. By contrast, headache may be captured as an Observation when it contributes to the establishment of a meningitis Condition.

Use the [Observation](#) 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.

Note that a Condition represents an instance of a condition, not the categorical patient state. This can be a subtle distinction for systemic conditions, but it is easier to see with conditions that can happen more than once, e.g. refuting one record of a wound does not mean that the patient does not have any other wounds, and resolving one case of otitis media does not rule out recurrence. An observation that the patient doesn't have any wounds means the patient doesn't have any wounds at that point in time.

When the diagnosis is related to an allergy or intolerance, the Condition and [AllergyIntolerance](#) resources can both be used. However, to be actionable for decision support, using Condition alone is not sufficient as the allergy or intolerance condition needs to be represented as an [AllergyIntolerance](#).

8.2 Resource Content

8.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Condition	TU		Domain Resource	<p>Detailed information about conditions, problems or diagnoses</p> <p>+ <i>Warning: If category is problems list item, the clinicalStatus should not be unknown</i></p> <p>+ <i>Rule: If condition is abated, then clinicalStatus must be either inactive, resolved, or remission.</i></p> <p>Elements defined in</p> <p>Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
 identifier	Σ	0..*	Identifier	External Ids for this condition
 clinicalStatus	$?\Sigma C$	1..1	CodeableConcept	active recurrence relapse inactive remission resolved unknown Binding: Condition Clinical Status Codes (Required)
 verificationStatus	$?\Sigma$	0..1	CodeableConcept	unconfirmed provisional differential confirmed refuted entered-in-error Binding: Condition Verification Status (Required)
 category	C	0..*	CodeableConcept	problem-list-item encounter-diagnosis Binding: Condition Category Codes (Preferred)
 severity		0..1	CodeableConcept	Subjective severity of condition Binding: Condition/Diagnosis Severity (Preferred)
 code	Σ	0..1	CodeableConcept	Identification of the condition, problem or diagnosis Binding: Condition/Problem/Diagnosis Codes (Example)

 bodySite	Σ	0..*	CodeableConcept	Anatomical location, if relevant
			concept	Binding: SNOMED CT Body Structures (Example)
  subject	Σ	1..1	Reference(Patient Group)	Who has the condition?
  encounter	Σ	0..1	Reference(Encounter)	The Encounter during which this Condition was created
 onset[x]	Σ	0..1		Estimated or actual date, date-time, or age
			dateTime	
 onsetDateTime				
			Age	
 onsetPeriod			Period	
 onsetRange			Range	
 onsetString			string	
  abatement[x]	C	0..1		When in resolution/remission
			dateTime	
 abatementDateTime				

			<u>Age</u>	
			<u>Period</u>	
			<u>Range</u>	
			<u>string</u>	
		Σ	0..1	<u>dateTime</u> Date condition was first recorded
	 recordedD			
		Σ	0..*	<u>BackboneElement</u> Who or what participated in the activities related to the condition and how they were involved
	 participant			
	 function	Σ	0..1	<u>CodeableConcept</u> Type of involvement Binding: Participation Role Type (Extensible)
	 actor	Σ	1..1	<u>Reference(Practitioner PractitionerRole Patient RelatedPerson Device Organization CareTeam)</u> Who or what participated in the activities related to the condition
	 stage	CTU	0..*	<u>BackboneElement</u> Stage/grade, usually assessed formally + Rule: <i>Stage SHALL have summary or assessment</i>

 summary	 CodeableConcept	0..1	CodeableConcept	Simple summary (disease specific) Binding: Condition Stage (Example)
 assessment	 CodeableConcept	0..*	Reference(ClinicalImpression DiagnosticReport Observation)	Formal record of assessment
 type		0..1	CodeableConcept	Kind of staging Binding: Condition Stage Type (Example)
 evidence	 CodeableReference	0..*	CodeableReference(Any)	Supporting evidence for the verification status Binding: SNOMED CT Clinical Findings (Example)
 note		0..*	Annotation	Additional information about the Condition

8.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
"type": "Condition",
  "profile": {
    "reference": "https://www.hl7.org/fhir/condition.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "vread"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance"
    },
    {
      "code": "history-type"
    }
  ]
}
```

```
},
{
  "code": "search-type"
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?
  "resourceType" : "Condition",
  // from Resource: id, meta, implicitRules, and language
  // from DomainResource: text, contained, extension, and modifierExtension
  "identifier" : [{ Identifier }], // External Ids for this condition
  "clinicalStatus" : { CodeableConcept }, // I R! active | recurrence | relapse | inactive | remission | resolved | unknown
  "verificationStatus" : { CodeableConcept }, // unconfirmed | provisional | differential | confirmed | refuted | entered-in-error
  "category" : [{ CodeableConcept }], // I problem-list-item | encounter-diagnosis
  "severity" : { CodeableConcept }, // Subjective severity of condition
  "code" : { CodeableConcept }, // Identification of the condition, problem or diagnosis
  "bodySite" : [{ CodeableConcept }], // Anatomical location, if relevant
  "subject" : { Reference(Group|Patient) }, // R! Who has the condition?
  "encounter" : { Reference(Encounter) }, // The Encounter during which this Condition was created
  // onset[x]: Estimated or actual date, date-time, or age. One of these 5:
  "onsetDateTime" : "<dateTime>",
  "onsetAge" : { Age },
  "onsetPeriod" : { Period },
  "onsetRange" : { Range },
  "onsetString" : "<string>",
  // abatement[x]: When in resolution/remission. One of these 5:
  "abatementDateTime" : "<dateTime>",
  "abatementAge" : { Age },
  "abatementPeriod" : { Period },
  "abatementRange" : { Range },
  "abatementString" : "<string>",
  "recordedDate" : "<dateTime>", // Date condition was first recorded
```

```
"participant" : [{ // Who or what participated in the activities related to the condition and how they were involved
  "function" : { CodeableConcept }, // Type of involvement
  "actor" : { Reference(CareTeam|Device|Organization|Patient|Practitioner|
    PractitionerRole|RelatedPerson) } // R! Who or what participated in the activities related to the condition
},
"stage" : [{ // Stage/grade, usually assessed formally
  "summary" : { CodeableConcept }, // I Simple summary (disease specific)
  "assessment" : [{ Reference(ClinicalImpression|DiagnosticReport|Observation) }], // I Formal record of assessment
  "type" : { CodeableConcept } // Kind of staging
},
"evidence" : [{ CodeableReference(Any) }], // Supporting evidence for the verification status
"note" : [{ Annotation }] // Additional information about the Condition
}
```

8.2.3 Terminology Bindings

Path	ValueSet	Type	Documentation
Condition.clinicalStatus	ConditionClinicalStatusCodes	Required	Preferred value set for Condition Clinical Status.
Condition.verificationStatus	ConditionVerificationStatus	Required	The verification status to support or decline the clinical status of the condition or diagnosis.
Condition.category	ConditionCategoryCodes	Preferred	Preferred value set for Condition Categories.
Condition.severity	ConditionDiagnosisSeverity	Preferred	Preferred value set for Condition/Diagnosis severity grading.
Condition.code	ConditionProblemDiagnosisCode Example S		Example value set for Condition/Problem/Diagnosis codes.

Condition.bodySite	SNOMEDCTBodyStructures	Example	This value set includes all codes from SNOMED CT where concept is-a 442083009 (Anatomical or acquired body site (body structure)).
Condition.participant.function	ParticipationRoleType	Extensible	This FHIR value set is comprised of Actor participation Type codes, which can be used to value FHIR agents, actors, and other role elements. The codes are intended to express how the agent participated in some activity. Sometimes referred to the agent functional-role relative to the activity.
Condition.stage.summary	ConditionStage	Example	Value set for stages of cancer and other conditions.
Condition.stage.type	ConditionStageType	Example	Example value set for the type of stages of cancer and other conditions
Condition.evidence	SNOMEDCTClinicalFindings	Example	This value set includes all the "Clinical finding" SNOMED CT codes - concepts where concept is-a 404684003 (Clinical finding (finding)).

8.2.4 Constraints

Unique Key	Level	Location	Description	Expression
✓ con-1 Rule	Condition	Stage SHALL .stage	have summary or assessment	summary.exists() or assessment.exists()
✓ con-2 Warning	(base)	If category is problems list item, the clinicalStatus should not be unknown		category.coding.where(system='http://terminology.hl7.org/CodeSystem/condition-category' and code='problem-list-item').exists() implies clinicalStatus.coding.where(system='http://terminology.hl7.org/CodeSystem/condition-clinical' and code='unknown').exists().not()
✓ con-3 Rule	(base)	If condition is abated, then clinicalStatus must be either inactive, resolved, or remission.		abatement.exists() implies (clinicalStatus.coding.where(system='http://terminology.hl7.org/CodeSystem/condition-clinical' and (code='inactive' or code='resolved' or code='remission')).exists())

8.2.5 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 as "history of X" and "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.

8.2.6 "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](#) 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.

Note to Implementers: There are two primary ways of reporting "no known problems" in the current specification: using the CodeableConcept, as described above, or using the [List](#) resource with emptyReason. During the STU period, [feedback](#) is sought regarding the preferred approach.

Provide feedback [here](#).

Patient Denies Condition

When the patient denies a condition, that can be annotated in the Condition.note element.

8.2.7 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 Condition was considered present and subsequent evidence refuted it. Specifically, Condition.verificationStatus can convey refuted. The corresponding evidence of that refutation can be conveyed in Condition.evidence. When the condition is refuted, other elements may be retained for legal reasons, but those other elements are no longer clinically relevant.
- 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.

8.2.8 Use of Condition.evidence

The Condition.evidence provides the basis for whatever is present in Condition.code.

8.2.9 Use of Condition.abatementRange

A range is used to communicate an imprecise age of the subject at the time of abatement.

8.2.10 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.

8.2.11 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.

8.2.12 Diagnosis Role and Rank within an Encounter

To represent the role of the diagnosis within an encounter, such as admission diagnosis or discharge diagnosis, use [Encounter.diagnosis.role](#).

To represent the numeric ranking of the diagnosis within an encounter, such as primary, secondary, or tertiary, use [Encounter.diagnosis.rank](#).

8.2.13 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.

8.2.14 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "clinical-status",  
        "type": "token"  
    },  
    {  
        "name": "verification-status",  
        "type": "token"  
    },  
    {  
        "name": "category",  
        "type": "token"  
    },  
    {  
        "name": "code",  
        "type": "token"  
    },  
    {  
        "name": "patient",  
        "type": "reference"  
    },  
    {  
        "name": "_lastUpdated",  
        "type": "date"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    },  
    {  
        "name": "abatement-age",  
        "type": "quantity"  
    },  
    {  
        "name": "abatement-boolean",  
        "type": "token"  
    },  
    {  
        "name": "abatement-date",  
        "type": "date"  
    },  
    {  
        "name": "abatement-string",  
        "type": "string"  
    },  
    {  
        "name": "asserted-date",  
        "type": "date"  
    },  
    {  
        "name": "asserter",  
        "type": "reference"  
    },  
    {  
        "name": "body-site",  
        "type": "token"  
    },  
    {  
        "name": "context",  
        "type": "reference"  
    },  
]
```

```
{
  "name": "encounter",
  "type": "reference"
},
{
  "name": "evidence",
  "type": "token"
},
{
  "name": "evidence-detail",
  "type": "reference"
},
{
  "name": "onset-age",
  "type": "quantity"
},
{
  "name": "onset-date",
  "type": "date"
},
{
  "name": "onset-info",
  "type": "string"
},
{
  "name": "severity",
  "type": "token"
},
{
  "name": "stage",
  "type": "token"
},
{
  "name": "subject",
  "type": "reference"
},
{
  "name": "recorded-date",
  "type": "date"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
abatement- age	quantity	Abatement as age or age range	Condition.abatement.ofType(Age) Condition.abatement.ofType(Range)	
abatement- date	date	Date-related abatements	Condition.abatement.ofType(dateTime) Condition.abatement.ofType(Period) (dateTime and period)	
abatement- string	string	Abatement as a string	Condition.abatement.ofType(string)	

body-site	token	Anatomical location, if Condition.bodySite relevant	
category	token	The category of the condition	Condition.category
clinical-status	token	The clinical status of the condition	Condition.clinicalStatus
code	token	Code for the condition	Condition.code 22 Resources
encounter	reference	The Encounter during which this Condition was created	Condition.encounter (Encounter) 29 Resources
evidence	token	Manifestation/symptom	Condition.evidence.concept
evidence-detail	reference	Supporting information found elsewhere	Condition.evidence.reference
identifier	token	A unique identifier of the condition record	Condition.identifier 65 Resources
onset-age	quantity	Onsets as age or age range	Condition.onset.ofType(Age) Condition.onset.ofType(Range)
onset-date	date	Date related onsets (dateTime and Period)	Condition.onset.ofType(dateTime) Condition.onset.ofType(Period)
onset-info	string	Onsets as a string	Condition.onset.ofType(string)
patient	reference	Who has the condition?	Condition.subject.where(resolve() is Patient) 66 Resources (Patient)

<u>recorded-date</u>	<u>date</u>	Date record was first recorded	Condition.recordedDate
<u>severity</u>	<u>token</u>	The severity of the condition	Condition.severity
<u>stage</u>	<u>token</u>	Simple summary (disease specific)	Condition.stage.summary
<u>subject</u>	<u>reference</u>	Who has the condition?	Condition.subject (Group , Patient)
<u>verification-status</u>	<u>token</u>	unconfirmed provisional differential confirmed refuted entered-in-error	Condition.verificationStatus

8.2.15 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/condition-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/condition-definitions.html
Mappings	http://hl7.org/fhir/R4/condition-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/condition-profiles.html

9 Coverage

Note: the following sections reference the FHIR standards version R4

Definition: Financial instrument which may be used to reimburse or pay for health care products and services. Includes both insurance and self-payment.

9.1 Scope and Usage

The Coverage resource is intended to provide the high-level identifiers and descriptors of an insurance plan, typically the information which would appear on an insurance card, which may be used to pay, in part or in whole, for 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. Selfpay should not be confused with being a guarantor of the patient's account.

The Coverage resource is a "event" resource from a FHIR workflow perspective - see [Workflow Request](#).

9.1.1 Boundaries and Relationships

The eClaim domain includes a number of related insurance resources

Coverage	The Coverage resource is intended to provide the high-level identifiers and descriptors of a specific insurance plan for a specific individual - essentially the insurance card information. This may alternately provide the individual or organization, selfpay, which will pay for products and services rendered.
Contract	A Contract resource holds the references to parties who have entered into an agreement of some type, the parties who may sign or witness such an agreement, descriptors of the type of agreement and even the actual text or executable copy of the agreement. The agreement may be of a variety of types including service contracts, insurance contracts, directives, etc. The contract may be either definitional or actual instances.
InsurancePlan	The InsurancePlan resource holds the definition of an insurance plan which an insurer may offer to potential clients through insurance brokers or an online insurance marketplace. This is only the plan definition and does not contain or reference a list of individuals who have purchased the plan.

9.2 Resource Content

9.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Coverage	 TU		DomainResource	Insurance or medical plan or a payment agreement Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	 Σ	0..*	Identifier	Business Identifier for the coverage
 status	 ?Σ	1..1	code	active cancelled draft entered-in-error Financial Resource Status Codes (Required)
 type	 Σ	0..1	CodeableConcept	Coverage category such as medical or accident Coverage Type and Self-Pay Codes (Preferred)
 policyHolder	 Σ	0..1	Reference(Patient) RelatedPerson Organization	Owner of the policy
 subscriber	 Σ	0..1	Reference(Patient) RelatedPerson	Subscriber to the policy
 subscriberId	 Σ	0..1	string	ID assigned to the subscriber
 beneficiary	 Σ	1..1	Reference(Patient)	Plan beneficiary
 dependent	 Σ	0..1	string	Dependent number
 relationship		0..1	CodeableConcept	Beneficiary relationship to the subscriber SubscriberPolicyholder Relationship Codes (Extensible)

 period	Σ	0..1	Period	Coverage start and end dates
  payor	Σ	1..*	Reference(Organization Patient RelatedPerson)	Issuer of the policy
  class		0..*	BackboneElement	Additional coverage classifications
  type	Σ	1..1	CodeableConcept	Type of class such as 'group' or 'plan' Coverage Class Codes (Extensible)
  value	Σ	1..1	string	Value associated with the type
  name	Σ	0..1	string	Human readable description of the type and value
  order	Σ	0..1	positiveInt	Relative order of the coverage
  network	Σ	0..1	string	Insurer network
 costToBeneficiary		0..*	BackboneElement	Patient payments for services/products
 costToBeneficiary				
  type	Σ	0..1	CodeableConcept	Cost category Coverage Copay Type Codes (Extensible)
  value[x]	Σ	1..1		The amount or percentage due from the beneficiary
 valueQuantity			SimpleQuantity	
 valueMoney			Money	
 exception		0..*	BackboneElement	Exceptions for patient payments
  type	Σ	1..1	CodeableConcept	Exception category Example Coverage Financial Exception Codes (Example)

 period	Σ	0..1	Period	The effective period of the exception
 subrogation		0..1	boolean	Reimbursement to insurer
 contract		0..*	Reference(Contract)	Contract details

9.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
"type": "Coverage",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/coverage.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "vread"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance"
    },
    {
      "code": "history-type"
    },
    {
      "code": "search-type"
    }
  ]
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4).

Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Coverage",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [ { Identifier } ], // Business Identifier for the coverage  
  "status" : "<code>", // R! active | cancelled | draft | entered-in-error  
  "type" : { CodeableConcept }, // Coverage category such as medical or accident  
  "policyHolder" : { Reference(Patient|RelatedPerson|Organization) }, // Owner of the policy  
  "subscriber" : { Reference(Patient|RelatedPerson) }, // Subscriber to the policy  
  "subscriberId" : "<string>", // ID assigned to the subscriber  
  "beneficiary" : { Reference(Patient) }, // R! Plan beneficiary  
  "dependent" : "<string>", // Dependent number  
  "relationship" : { CodeableConcept }, // Beneficiary relationship to the subscriber  
  "period" : { Period }, // Coverage start and end dates  
  "payor" : [ { Reference(Organization|Patient|RelatedPerson) } ], // R! Issuer of the policy  
  "class" : [ { // Additional coverage classifications  
    "type" : { CodeableConcept }, // R! Type of class such as 'group' or 'plan'  
    "value" : "<string>", // R! Value associated with the type  
    "name" : "<string>" // Human readable description of the type and value  
  } ],  
  "order" : "<positiveInt>", // Relative order of the coverage  
  "network" : "<string>", // Insurer network  
  "costToBeneficiary" : [ { // Patient payments for services/products  
    "type" : { CodeableConcept }, // Cost category  
    // value[x]: The amount or percentage due from the beneficiary. One of these 2:  
    "valueQuantity" : { Quantity(SimpleQuantity) },  
    "valueMoney" : { Money },  
    "exception" : [ { // Exceptions for patient payments  
      "type" : { CodeableConcept }, // R! Exception category  
      "period" : { Period } // The effective period of the exception  
    } ]  
  } ]
```

```
  }]
  ],
  "subrogation" : <boolean>, // Reimbursement_to_insurer
  "contract" : [{ Reference(Contract) }] // Contract_details
}
```

9.2.3 Terminology Bindings

Path	Definition	Type	Reference
Coverage.status	A code specifying the state of the resource instance.	Required	FinancialResourceStatusCodes
Coverage.type	The type of insurance: public health, worker compensation; private accident, auto, private health, etc.) or a direct payment by an individual or organization.	Preferred	CoverageTypeAndSelf-PayCodes
Coverage.relationship	The relationship between the Subscriber and the Beneficiary (insured/covered party/patient).	Extensible	SubscriberRelationshipCodes
Coverage.class.type	The policy classifications, eg. Group, Plan, Class, etc.	Extensible	CoverageClassCodes

Coverage.costToBeneficiary.type	The types of services to which patient copayments are specified.	Extensible	CoverageCopayTypeCodes
Coverage.costToBeneficiary.exception.type	The types of exceptions from the part or full value of financial obligations such as copays.	Example	ExampleCoverageFinancialExceptionCodes

9.2.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  {    "name": "beneficiary",    "type": "reference"  },  {    "name": "class-type",    "type": "token"  },  {    "name": "class-value",    "type": "string"  },  {    "name": "dependent",    "type": "string"  },  {    "name": "identifier",    "type": "token"  },  {    "name": "patient",    "type": "reference"  },  {    "name": "payor",    "type": "reference"  },  {    "name": "policy-holder",    "type": "reference"  },  {    "name": "status",    "type": "token"  }]
```

```
        "name": "subscriber",
        "type": "reference"
    },
    {
        "name": "type",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
beneficiary	reference	Covered party	Coverage.beneficiary (Patient)	
class-type	token	Coverage class (eg. plan, group)	Coverage.class.type	
class-value	string	Value of the class (eg. Plan number, group number)	Coverage.class.value	
dependent	string	Dependent number	Coverage.dependent	
identifier	token	The primary identifier of the insured and the coverage	Coverage.identifier	
patient	reference	Retrieve coverages for a patient	Coverage.beneficiary (Patient)	
payor	reference	The identity of the insurer or party paying for services	Coverage.payor (Organization , Patient , RelatedPerson)	
policy-holder	reference	Reference to the policyholder	Coverage.policyHolder (Organization , Patient , RelatedPerson)	
status	token	The status of the Coverage	Coverage.status	

subscriber	reference	Reference to the subscriber	Coverage.subscriber (Patient , RelatedPerson)
type	token	The kind of coverage (health plan, auto, Workers Compensation)	Coverage.type

9.2.5

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/coverage-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/coverage-definitions.html
Mappings	https://hl7.org/fhir/R4/coverage-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/coverage-profiles.html

10 Device

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/device.html>

A type of a manufactured item that is used in the provision of healthcare without being substantially changed through that activity. The device may be a medical or non-medical device.

10.1 Scope and Usage

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

10.1.2 Boundaries and Relationships

These are the device related resources

- Device (this resource)
- [DeviceDefinition](#) - Describes a "kind" of device - not a physical instance, cut a "catalog entry" where a device is defined by the manufacturer, reseller, or regulator.
- [DeviceMetric](#) - Describes a measurement, calculation or setting capability of a medical device.

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 represented by the Devices pointing to their "parent".

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](#) resource should not be used to represent implanted devices.

10.2 Resource Content

10.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Device	TU		DomainResource	Item used in healthcare Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier		0..*	Identifier	Instance identifier
 definition		0..1	Reference(DeviceDefinition)	The reference to the definition for the device

 udiCarrier	Σ	0..*	BackboneElement	Unique Device Identifier (UDI) Barcode string
 deviceIdentifier	Σ	0..1	string	Mandatory fixed portion of UDI
 issuer		0..1	uri	UDI Issuing Organization
 jurisdiction		0..1	uri	Regional UDI authority
 carrierAIDC	Σ	0..1	base64Binary	UDI Machine Readable Barcode String
 carrierHRF	Σ	0..1	string	UDI Human Readable Barcode String
 entryType		0..1	code	barcode rfid manual + UDIEEntryType (Required)
 status	$?!\Sigma$	0..1	code	active inactive entered-in-error unknown FHIRDeviceStatus (Required)
 statusReason		0..*	CodeableConcept	online paused standby offline not-ready transduc- discon hw-discon off FHIRDeviceStatusReason (Extensible)
 distinctIdentifier		0..1	string	The distinct identification string
 manufacturer		0..1	string	Name of device manufacturer
 manufactureDate		0..1	dateTime	Date when the device was made
 expirationDate		0..1	dateTime	Date and time of expiry of this device (if applicable)
 lotNumber		0..1	string	Lot number of manufacture

 serialNumber	0..1	string	Serial number assigned by the manufacturer
 deviceName	0..*	BackboneElement	The name of the device as given by the manufacturer
 name	1..1	string	The name of the device
 type	1..1	code	udi-label-name user-friendly-name patient-reported-name manufacturer-name model-name other DeviceNameType (Required)
 modelNumber	0..1	string	The model number for the device
 partNumber	0..1	string	The part number of the device
 type	0..1	CodeableConcept	The kind or type of device Device Type (Example)
 specialization	0..*	BackboneElement	The capabilities supported on a device, the standards to which the device conforms for a particular purpose, and used for the communication
 systemType	1..1	CodeableConcept	The standard that is used to operate and communicate
 version	0..1	string	The version of the standard that is used to operate and communicate
 version	0..*	BackboneElement	The actual design of the device or software version running on the device
 type	0..1	CodeableConcept	The type of the device version
 component	0..1	Identifier	A single component of the device version
 value	1..1	string	The version text
 property	0..*	BackboneElement	The actual configuration settings of a device as it actually operates, e.g., regulation status, time properties

 type	1..1	CodeableConcept	Code that specifies the property DeviceDefinitionPropertyCode (Extensible)
 valueQuantity	0..*	Quantity	Property value as a quantity
 valueCode	0..*	CodeableConcept	Property value as a code, e.g., NTP4 (synced to NTP)
 patient	0..1	Reference(Patient)	Patient to whom Device is affixed
 owner	0..1	Reference(Organization)	Organization responsible for device
 location	0..1	Reference(Location)	Where the device is found
 url	0..1	uri	Network address to contact device
 parent	0..1	Reference(Device)	The parent device

10.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Device",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/device.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "vread"
    },
    {
      "code": "history-type"
    },
    {
      "code": "history-instance"
    }
  ]
}
```

```
        "code": "patch"
    },
    {
        "code": "search-type"
    }
],
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Device",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Instance identifier  
  "definition" : { Reference(DeviceDefinition) }, // The reference to the definition for the device  
  "udiCarrier" : [{ // Unique Device Identifier (UDI) Barcode string  
    "deviceIdentifier" : "<string>", // Mandatory fixed portion of UDI  
    "issuer" : "<uri>", // UDI Issuing Organization  
    "jurisdiction" : "<uri>", // Regional UDI authority  
    "carrierAIDC" : "<base64Binary>", // UDI Machine Readable Barcode String  
    "carrierHRF" : "<string>", // UDI Human Readable Barcode String  
    "entryType" : "<code>" // barcode | rfid | manual +  
  }],  
  "status" : "<code>", // active | inactive | entered-in-error | unknown  
  "statusReason" : [{ CodeableConcept }], // online | paused | standby | offline | not-ready | trans  
  duc-discon | hw-discon | off  
  "distinctIdentifier" : "<string>", // The distinct identification string  
  "manufacturer" : "<string>", // Name of device manufacturer  
  "manufactureDate" : "<dateTime>", // Date when the device was made  
  "expirationDate" : "<dateTime>", // Date and time of expiry of this device (if applicable)  
  "lotNumber" : "<string>", // Lot number of manufacture  
  "serialNumber" : "<string>", // Serial number assigned by the manufacturer  
  "deviceName" : [{ // The name of the device as given by the manufacturer  
    "name" : "<string>", // R! The name of the device  
    "type" : "<code>" // R! udi-label-name | user-friendly-name | patient-reported-name | manufacturer-name | model-name | other
```

```
],
  "modelNumber" : "<string>", // The model number for the device
  "partNumber" : "<string>", // The part number of the device
  "type" : { CodeableConcept }, // The kind or type of device
  "specialization" : [{ // The capabilities supported on a device, the standards to which the device conforms for a particular purpose, and used for the communication
    "systemType" : { CodeableConcept }, // R! The standard that is used to operate and communicate
    "version" : "<string>" // The version of the standard that is used to operate and communicate
  }],
  "version" : [{ // The actual design of the device or software version running on the device
    "type" : { CodeableConcept }, // The type of the device version
    "component" : { Identifier }, // A single component of the device version
    "value" : "<string>" // R! The version text
  }],
  "property" : [{ // The actual configuration settings of a device as it actually operates, e.g., regulation status, time properties
    "type" : { CodeableConcept }, // R! Code that specifies the property DeviceDefinitionPropertyCode (Extensible)
    "valueQuantity" : [{ Quantity }], // Property value as a quantity
    "valueCode" : [{ CodeableConcept }] // Property value as a code, e.g., NTP4 (synced to NTP)
  }],
  "patient" : { Reference(Patient) }, // Patient to whom Device is affixed
  "owner" : { Reference(Organization) }, // Organization responsible for device
  "contact" : [{ ContactPoint }], // Details for human/organization for support
  "location" : { Reference(Location) }, // Where the device is found
  "url" : "<uri>", // Network address to contact device
  "note" : [{ Annotation }], // Device notes and comments
  "safety" : [{ CodeableConcept }], // Safety Characteristics of Device
  "parent" : { Reference(Device) } // The parent device
}
```

10.2.3 Terminology Bindings

Path	Definition	Type	Reference
Device.udiCarrier.entryType	Codes to identify how UDI data was entered.	Required	UDIEEntryType

Device.status	The availability status of the device.	Required	FHIRDeviceStatus
Device.statusReason	The availability status reason of the device.	Extensible	FHIRDeviceStatusReason
Device.deviceName.type	The type of name the device is referred by.	Required	DeviceNameType
Device.type	Codes to identify medical devices.	Example	DeviceType

10.2.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "device-name",
    "type": "string"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "location",
    "type": "reference"
  },
  {
    "name": "manufacturer",
    "type": "string"
  },
  {
    "name": "model",
    "type": "string"
  },
  {
    "name": "organization",
    "type": "reference"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "status",
    "type": "token"
  },
  {
    "name": "type",
    "type": "token"
  },
  {
    "name": "udi-carrier",
    "type": "string"
  }
]
```

```
  },
  {
    "name": "udi-di",
    "type": "string"
  },
  {
    "name": "url",
    "type": "uri"
  }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
device-name	string	A server defined search that may match any of the string fields in Device.deviceName or Device.type.	Device.deviceName.name Device.type.coding.display Device.type.text	
identifier	token	Instance id from manufacturer, owner, and others	Device.identifier	
location	reference	A location, where the resource is found	Device.location (Location)	
manufacturer	string	The manufacturer of the device	Device.manufacturer	
model	string	The model of the device	Device.modelNumber	
organization	reference	The organization responsible for the device	Device.owner (Organization)	
patient	reference	Patient information, if the resource is affixed to a person	Device.patient (Patient)	
status	token	active inactive entered-in-error unknown	Device.status	

type	token	The type of the device	Device.type
udi-carrier	string	UDI Barcode (RFID or other Device.udiCarrier.carrierHRF technology) string in *HRF* format.	
udi-di	string	The udi Device Identifier (DI)	Device.udiCarrier.deviceIdentifier
url	uri	Network address to contact device	Device.url

10.2.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/device-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/device-definitions.html
Mappings	http://hl7.org/fhir/R4/device-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/device-profiles.html

11 Diagnostic Report

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/diagnosticreport.html>

Definition: The findings and interpretation of diagnostic tests performed on patients, groups of patients, devices, and locations, and/or specimens derived from these. The report includes clinical context such as requesting and provider information, and some mix of atomic results, images, textual and coded interpretations, and formatted representation of diagnostic reports.

11.1 Scope and Usage

This resource is an *event* resource from a FHIR workflow perspective - see [Workflow](#). It is the intent of the Orders and Observation Workgroup to align this resource with the workflow pattern for [event resources](#).

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](#), [RESTful API](#), or [Messaging](#) 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 laboratory 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.

11.2 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.

11.2.1 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](#) resource is used to describe the activity.

In contrast to the [Observation](#) 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 [ServiceRequest](#)) and allow the report to connect to clinical workflows. For more narrative driven reports with less work flow (histology/mortuary, etc.), the [Composition](#) 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 [ImagingStudy](#) resources which represent the content produced in a DICOM imaging study or set of DICOM Instances for a patient.

11.3 Resource Content

11.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

<u>Name</u>	<u>Flags</u>	<u>Card.</u>	<u>Type</u>	<u>Description & Constraints</u> 
 DiagnosticReport	TU		DomainResource	A Diagnostic report - a combination of request information, atomic results, images, interpretation, as well as formatted reports Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	Business identifier for report
 basedOn		0..*	Reference(CarePlan) ImmunizationRecommendation MedicationRequest NutritionOrder ServiceRequest)	What was requested
 status	$?!\Sigma$	1..1	code	registered partial preliminary final + DiagnosticReportStatus (Required)
 category	Σ	0..*	CodeableConcept	Service category Diagnostic Service Section Codes (Example)
 code	Σ	1..1	CodeableConcept	Name/Code for this diagnostic report LOINC Diagnostic Report Codes (Preferred)
 subject	Σ	0..1	Reference(Patient) Group Device Location)	The subject of the report - usually, but not always, the patient

 encounter	Σ	0..1	Reference(Encounter)	Health care event when test ordered
 effective[x]	Σ	0..1		Clinically relevant time/time-period for report
 effectiveDat			dateTime	
 effectivePeri od			Period	
 issued	Σ	0..1	instant	DateTime this version was made
 performer	Σ	0..*	Reference(Practitioner PractitionerRole Organization CareTeam)	Responsible Diagnostic Service
 resultsInterp reter	Σ	0..*	Reference(Practitioner PractitionerRole Organization CareTeam)	Primary result interpreter
 specimen		0..*	Reference(Specimen)	Specimens this report is based on
 result		0..*	Reference(Observation)	Observations
 imagingStud y		0..*	Reference(ImagingStudy)	Reference to full details of imaging associated with the diagnostic report
 media	Σ	0..*	BackboneElement	Key images associated with this report
 comment		0..1	string	Comment about the image (e.g. explanation)
 link	Σ	1..1	Reference(Media)	Reference to the image source
 conclusion		0..1	string	Clinical conclusion (interpretation) of test results

 conclusionCode	0..*	CodeableConcept	Codes for the clinical conclusion of test results SNOMED CT Clinical Findings (Example)
 presentedForm	0..*	Attachment	Entire report as issued

11.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "DiagnosticReport",
  "profile": {
    "reference": "http://www.hl7.org/fhir/DiagnosticReport.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    },
    {
      "code": "vread",
      "documentation": "Read the state of a specific version of the resource"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance",
      "documentation": "Retrieve the change history for a particular resource."
    },
    {
      "code": "history-type",
      "documentation": "Retrieve the change history for all resources of a
particular type"
    },
    {
      "code": "search-type",
      "documentation": "Search the resource type based on some filter criteria"
    }
  ]
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "DiagnosticReport",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Business identifier for report  
  "basedOn" : [{ Reference(CarePlan|ImmunizationRecommendation|MedicationRequest|NutritionOrder|ServiceRequest) }], // What was requested  
  "status" : "<code>", // R! registered | partial | preliminary | final +  
  "category" : [{ CodeableConcept }], // Service category  
  "code" : { CodeableConcept }, // R! Name/Code for this diagnostic report  
  "subject" : { Reference(Patient|Group|Device|Location) }, // The subject of the report - usually, but not always, the patient  
  "encounter" : { Reference(Encounter) }, // Health care event when test ordered  
  // effective[x]: Clinically relevant time/time-period for report. One of these 2:  
  "effectiveDateTime" : "<dateTime>",  
  "effectivePeriod" : { Period },  
  "issued" : "<instant>", // DateTime this version was made  
  "performer" : [{ Reference(Practitioner|PractitionerRole|Organization|CareTeam) }], // Responsible Diagnostic Service  
  "resultsInterpreter" : [{ Reference(Practitioner|PractitionerRole|Organization|CareTeam) }], // Primary result interpreter  
  "specimen" : [{ Reference(Specimen) }], // Specimens this report is based on  
  "result" : [{ Reference(Observation) }], // Observations  
  "imagingStudy" : [{ Reference(ImagingStudy) }], // Reference to full details of imaging associated with the diagnostic report  
  "media" : [{ // Key images associated with this report  
    "comment" : "<string>", // Comment about the image (e.g. explanation)  
    "link" : { Reference(Media) } // R! Reference to the image source  
  }],  
  "conclusion" : "<string>", // Clinical conclusion (interpretation) of test results  
  "conclusionCode" : [{ CodeableConcept }], // Codes for the clinical conclusion of test results
```

```
"presentedForm" : [{ Attachment }] // Entire report as issued  
}
```

11.3.3 Terminology Bindings

Path	Definition	Type	Reference
DiagnosticReport.status	The status of the diagnostic report.	Required	DiagnosticReportStatus
DiagnosticReport.category	Codes for diagnostic service sections.	Example	DiagnosticServiceSectionCodes
DiagnosticReport.code	Codes that describe Diagnostic Reports.	Preferred	LOINCDiagnosticReportCodes
DiagnosticReport.conclusionCode	Diagnosis codes provided as adjuncts to the report.	Example	SNOMEDCTClinicalFindings

11.3.4 Identifiers

The [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 '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://terminology.hl7.org/CodeSystem/v2-0203"/>  
  <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://terminology.hl7.org/CodeSystem/v2-0203"/>

  <code value="PLAC"/>

</coding>

<text value="Placer"/>

</type>

<system value=" http://terminology.hl7.org/CodeSystem/v2-0203"/>

<value value="567890"/>

</identifier>
```

11.3.5 Clinically Relevant Time

If the diagnostic procedure was performed on the patient directly, the [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 an `effective[x]` element. Note that [HL7 v2](#) messages often carry a diagnostically relevant time without carrying any specimen information.

11.3.6 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](#), 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](#) is provided.

11.3.7 Associated Images

ImagingStudy and ImageObjectStudy and the **media** 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.

11.3.8 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.

11.3.9 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. This is typically 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. Therefore, these patterns described above are only examples of how a diagnostic report can be used.

11.3.10 Genetic Observations

Genetic reporting makes heavy use of the DiagnosticReport and Observation resources. An implementation guide describing how to represent genetic results can be found [here](#).

11.3.11 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "based-on",  
        "type": "reference"  
    },  
    {  
        "name": "category",  
        "type": "token"  
    },  
    {  
        "name": "code",  
        "type": "token"  
    },  
    {  
        "name": "language",  
        "type": "token"  
    },  
    {  
        "name": "value",  
        "type": "token"  
    }]
```

```
        "type": "token"
    },
    {
        "name": "conclusion",
        "type": "token"
    },
    {
        "name": "date",
        "type": "date"
    },
    {
        "name": "encounter",
        "type": "reference"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "issued",
        "type": "date"
    },
    {
        "name": "media",
        "type": "reference"
    },
    {
        "name": "patient",
        "type": "reference"
    },
    {
        "name": "performer",
        "type": "reference"
    },
    {
        "name": "result",
        "type": "reference"
    },
    {
        "name": "results-interpreter",
        "type": "reference"
    },
    {
        "name": "specimen",
        "type": "reference"
    },
    {
        "name": "status",
        "type": "token"
    },
    {
        "name": "subject",
        "type": "reference"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
based-on	reference	Reference to the service request.	DiagnosticReport.basedOn (CarePlan , MedicationRequest , NutritionOrder , ServiceRequest , ImmunizationRecommendatio n)	
category	token	Which diagnostic discipline/department created the report	DiagnosticReport.category	
code	token	The code for the report, as opposed to codes for the atomic results, which are the names on the observation resource referred to from the result	DiagnosticReport.code	13 Resources
conclusion	token	A coded conclusion (interpretation/impression) on the report	DiagnosticReport.conclusionC ode	
date	date	The clinically relevant time of the report	DiagnosticReport.effective	17 Resources
encounter	reference	The Encounter when the order was made	DiagnosticReport.encounter (Encounter)	12 Resources
identifier	token	An identifier for the report	DiagnosticReport.identifier	30 Resources
issued	date	When the report was issued	DiagnosticReport.issued	

media	reference A reference to the image source.	DiagnosticReport.media.link (Media)
patient	reference The subject of the report if a patient	DiagnosticReport.subject.where(resolve() is Patient) (Patient)
performer	reference Who is responsible for the report	DiagnosticReport.performer (Practitioner , Organization , CareTeam , PractitionerRole)
result	reference Link to an atomic result (observation resource)	DiagnosticReport.result (Observation)
results-interpreter	reference Who was the source of the report	DiagnosticReport.resultsInterpreter (Practitioner , Organization , CareTeam , PractitionerRole)
specimen	reference The specimen details	DiagnosticReport.specimen (Specimen)
status	token The status of the report	DiagnosticReport.status
subject	reference The subject of the report	DiagnosticReport.subject (Group , Device , Patient , Location)

11.3.12 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/diagnosticreport-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/diagnosticreport-definitions.html
Mappings	http://hl7.org/fhir/R4/diagnosticreport-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/diagnosticreport-profiles.html

12 Document Reference

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/documentreference.html>

A reference to a document of any kind for any purpose. Provides metadata about the document so that the document can be discovered and managed. The scope of a document is any serialized object with a mime-type, so includes formal patient centric documents (CDA), clinical notes, scanned paper, and non-patient specific documents like policy text.

12.1 Scope and Usage

A DocumentReference resource is used to index a document, clinical note, and other binary objects to make them 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](#), such as profiled in [IHE Mobile access to Health Documents](#).

DocumentReference is metadata describing a document such as:

- [CDA](#) documents in FHIR systems

- [FHIR documents](#) stored elsewhere (i.e. registry/repository following the XDS model)
- [PDF documents](#), Scanned Paper, and digital records of faxes
- Clinical Notes in various forms
- Image files (e.g., JPEG, GIF, TIFF)
- Non-Standard formats (e.g., WORD)
- Other kinds of documents, such as records of prescriptions or immunizations

12.1.1 Boundaries and Relationships

FHIR defines both a [document format](#) 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 assembled 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](#), 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](#) 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](#) 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](#) resource. This is discussed as [part of the description of the Provenance resource](#).

12.2 Resource Content

12.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Document	TU		Domain	A reference to a document
Reference			Resource	Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 masterIdentifier	Σ	0..1	Identifier	Master Version Specific Identifier
 identifier	Σ	0..*	Identifier	Other identifiers for the document
 status	$?!\Sigma$	1..1	code	current superseded entered-in-error DocumentReferenceStatus (Required)
 docStatus	Σ	0..1	code	preliminary final amended entered-in-error CompositionStatus (Required)
 type	Σ	0..1	Codeable	Kind of document (LOINC if possible)
			Concept	Document Type Value Set (Preferred)
 category	Σ	0..*	Codeable	Categorization of document
			Concept	Document Class Value Set (Example)
 subject	Σ	0..1	Reference	Who/what is the subject of the document
			(Patient	
			 Practitioner	
			 Group	

				up Device)	
 date	Σ	0..1	instant	When this document reference was created	
 author	Σ	0..*	Reference (Practitioner Practitioner Role Organization Device Patient Relationship Person)	Who and/or what authored the document	
 authenticator		0..1	Reference (Practitioner Practitioner Role Organization)	Who/what authenticated the document	
 custodian		0..1	Reference (Organization)	Organization which maintains the document	
 relatesTo	Σ	0..*	Backbone Element	Relationships to other documents	
 code	Σ	1..1	code	replaces transforms signs appends DocumentRelationshipType (Required)	
 target	Σ	1..1	Reference (DocumentReference)	Target of the relationship	

 Σ	0..1	string	Human-readable description
 description	Σ	0..*	Codeable Concept SecurityLabels (Extensible)
 content	Σ	1..*	Backbone Element Document referenced
 attachmen	Σ	1..1	Attachme nt Where to access the document
 format	Σ	0..1	Coding Format/content rules for the document DocumentReference Format Code Set (Preferred)
 context	Σ	0..1	Backbone Element Clinical context of document
 encounter	0..*	Referenc e(Encoun ter Epis odeOfCar	Context of the document content
 event	0..*	Codeable Concept	Main clinical acts documented v3 Code System ActCode (Example)
 period	Σ	0..1	Period Time of service that is being documented
 facilityTyp	0..1	Codeable Concept	Kind of facility where patient was seen Facility Type Code Value Set (Example)
 practiceSe	0..1	Codeable Concept	Additional details about where the content was created (e.g. clinical specialty) Practice Setting Code Value Set (Example)

		0..1	<u>Reference(Patient)</u>	Patient demographics from source
		0..*	<u>Reference(Any)</u>	Related identifiers or resources

12.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
  "type": "DocumentReference",  
  "profile": {  
    "reference": "http://hl7.org/fhir/R4/documentreference.html"  
  },  
  "interaction": [  
    {  
      "code": "read",  
      "documentation": "Read the current state of the resource"  
    },  
    {  
      "code": "create",  
      "documentation": "Create a new resource with a server assigned id"  
    },  
    {  
      "code": "update",  
      "documentation": "Update an existing resource by its id"  
    },  
    {  
      "code": "delete",  
      "documentation": "Delete a resource"  
    },  
    {  
      "code": "vread",  
      "documentation": "Read the state of a specific version of the resource"  
    },  
    {  
      "code": "patch"  
    },  
    {  
      "code": "history-instance",  
      "documentation": "Retrieve the change history for a particular resource."  
    },  
    {  
      "code": "history-type",  
      "documentation": "Retrieve the change history for all resources of a  
particular type"  
    },  
    {  
      "code": "search-type",  
      "documentation": "Search the resource type based on some filter criteria"  
    }  
  ],  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "DocumentReference",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "masterIdentifier" : { Identifier }, // Master Version Specific Identifier  
  "identifier" : [{ Identifier }], // Other identifiers for the document  
  "status" : "<code>", // R! current | superseded | entered-in-error  
  "docStatus" : "<code>", // preliminary | final | amended | entered-in-error  
  "type" : { CodeableConcept }, // Kind of document (LOINC if possible)  
  "category" : [{ CodeableConcept }], // Categorization of document  
  "subject" : { Reference(Patient|Practitioner|Group|Device) }, // Who/what is the subject of the document  
  "date" : "<instant>", // When this document reference was created  
  "author" : [{ Reference(Practitioner|PractitionerRole|Organization|Device|Patient|RelatedPerson) }], // Who and/or what authored the document  
  "authenticator" : { Reference(Practitioner|PractitionerRole|Organization) }, // Who/what authenticated the document  
  "custodian" : { Reference(Organization) }, // Organization which maintains the document  
  "relatesTo" : [{ // Relationships to other documents  
    "code" : "<code>", // R! replaces | transforms | signs | appends  
    "target" : { Reference(DocumentReference) } // R! Target of the relationship  
  }],  
  "description" : "<string>", // Human-readable description  
  "securityLabel" : [{ CodeableConcept }], // Document security-tags  
  "content" : [{ // R! Document referenced  
    "attachment" : { Attachment }, // R! Where to access the document  
    "format" : { Coding } // Format/content rules for the document  
  }],  
  "context" : { // Clinical context of document  
    "encounter" : [{ Reference(Encounter|EpisodeOfCare) }], // Context of the document content  
    "event" : [{ CodeableConcept }], // Main clinical acts documented
```

```
"period" : { Period }, // Time of service that is being documented
"facilityType" : { CodeableConcept }, // Kind of facility where patient was seen
"practiceSetting" : { CodeableConcept }, // Additional details about where the content was created \(e.g. clinical specialty\)
"sourcePatientInfo" : { Reference\(Patient\) }, // Patient demographics from source
"related" : [{ Reference\(Any\) }] // Related identifiers or resources
}
}
```

12.2.3 Terminology Bindings

Path	Definition	Type	Reference
DocumentReference.status	The status of the document reference.	Required	DocumentReferenceStatus
DocumentReference.docStatus	Status of the underlying document.	Required	CompositionStatus
DocumentReference.type	Precise type of clinical document.	Preferred	DocumentTypeValueSet
DocumentReference.category	High-level kind of a clinical document at a macro level.	Example	DocumentClassValueSet
DocumentReference.relatesTo.code	The type of relationship	Required	DocumentRelationshipType

	between documents.		
DocumentReference.securityLabel	Security Labels from the Healthcare Privacy and Security Classification System.	Extensible	All Security Labels
DocumentReference.content.format	Document Format Codes.	Preferred	DocumentReferenceFormatCodeSet
DocumentReference.context.event	This list of codes represents the main clinical acts being documented.	Example	v3.ActCode
DocumentReference.context.facilityType	XDS Facility Type.	Example	FacilityTypeCodeValueSet
DocumentReference.context.practiceSetting	Additional details about where the content was created (e.g. clinical specialty).	Example	PracticeSettingCodeValueSet

12.3 Implementation Notes

- The use of the .docStatus codes is discussed in the [Composition description](#)
- 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

12.3.1 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	The uri refers to an existing Document
CDA ↗ Document	The uri is a reference to a Binary 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).

12.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
    {
        "name": "authenticator",
        "type": "reference"
    },
    {
        "name": "author",
        "type": "reference"
    },
    {
        "name": "category",
        "type": "token"
    },
    {
        "name": "contenttype",
        "type": "token"
    },
    {
        "name": "event",
        "type": "token"
    },
    {
        "name": "facility",
        "type": "token"
    },
    {
        "name": "format",
        "type": "token"
    },
    {
        "name": "language",
        "type": "token"
    },
    {
        "name": "location",
        "type": "uri"
    },
    {
        "name": "period",
        "type": "date"
    },
    {
        "name": "related",
        "type": "reference"
    },
    {
        "name": "relatesto",
        "type": "reference"
    }
]
```

```
        "name": "relation",
        "type": "token"
    },
    {
        "name": "security-label",
        "type": "token"
    },
    {
        "name": "setting",
        "type": "token"
    },
    {
        "name": "subject",
        "type": "reference"
    },
    {
        "name": "custodian",
        "type": "reference"
    },
    {
        "name": "date",
        "type": "date"
    },
    {
        "name": "description",
        "type": "string"
    },
    {
        "name": "encounter",
        "type": "reference"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "patient",
        "type": "reference"
    },
    {
        "name": "status",
        "type": "token"
    },
    {
        "name": "type",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
authenticator	reference	Who/what authenticated the document	DocumentReference.authenticator (Practitioner , Organization , PractitionerRole)	
author	reference	Who and/or what authored the document	DocumentReference.author (Practitioner , Organization , Device , Patient , PractitionerRole , RelatedPerson)	
category	token	Categorization of document	DocumentReference.category	
contenttype	token	Mime type of the content, with charset etc.	DocumentReference.content.attachment.content Type	
custodian	reference	Organization which maintains the document	DocumentReference.custodian (Organization)	
date	date	When this document reference was created	DocumentReference.date	
description	string	Human-readable description	DocumentReference.description	

encounter	reference	Context of the document content	DocumentReference.context.encounter (EpisodeOfCare , Encounter)	12 Resources
event	token	Main clinical acts documented	DocumentReference.context.event	
facility	token	Kind of facility where patient was seen	DocumentReference.context.facilityType	
format	token	Format/content rules for the document	DocumentReference.content.format	
identifier	token	Master Version Specific Identifier	DocumentReference.masterIdentifier DocumentReference.identifier	30 Resources
language	token	Human language of the content (BCP-47)	DocumentReference.content.attachment.language	
location	uri	Uri where the data can be found	DocumentReference.content.attachment.url	
patient	reference	Who/what is the subject of the document	DocumentReference.subject.where(resolve() is Patient) (Patient)	33 Resources
period	date	Time of service that is being documented	DocumentReference.context.period	

related	reference	Related identifiers or resources	DocumentReference.context.related (Any)
relatesTo	reference	Target of the relationship	DocumentReference.relatesTo.target (DocumentReference)
relation	token	replaces transforms signs appends	DocumentReference.relatesTo.code
relationship	composite	Combination of relation and relatesTo	On DocumentReference.relatesTo: relatesTo: code relation: target
security-label	token	Document security-tags	DocumentReference.securityLabel
setting	token	Additional details about where the content was created (e.g. clinical specialty)	DocumentReference.context.practiceSetting
status	token	current superseded entered-in-error	DocumentReference.status
subject	reference	Who/what is the subject of the document	DocumentReference.subject (Practitioner , Group , Device , Patient)

type	<u>token</u>	Kind of document (LOINC if possible)	DocumentReference.type	<u>5</u> <u>Resources</u>
------	------------------------------	---	------------------------	--

12.4.1 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/documentreference-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/documentreference-definitions.html
Mappings	http://hl7.org/fhir/R4/documentreference-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/documentreference-profiles.html

13 Encounter

Note: the following sections reference the FHIR standards version R4 -
<http://hl7.org/fhir/R4/encounter.html>

Definition: An interaction between a patient and healthcare provider(s) for the purpose of providing healthcare service(s) or assessing the health status of a patient.

13.1 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](#) 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. It is always expected to be the same period as the encounter itself. Where the period is different, another encounter instance should be used to capture this information as 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 *Procedure.encounter*), and another for cases where an encounter is a result of another procedure (stored in *Encounter.indication*) such as a follow-up encounter to resolve complications from an earlier procedure.

13.1.2 Status Management

During the life-cycle of an encounter it will pass through many statuses. Typically these are in order or the organization's 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, checking the period of each, and then 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 whether 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 might or might 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.

13.1.3 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 at 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 simultaneous interaction between a practitioner and a patient where there is no direct contact. Examples include a phone message, or transmission of some correspondence documentation.

There is no duration recorded for a communication resource, but it 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.

13.2 Resource Content

13.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Encounter	TU		Domain Resource	An interaction during which services are provided to the patient Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
  identifier	Σ	0..*	Identifier	Identifier(s) by which this encounter is known
  status	$?!\Sigma$	1..1	code	planned arrived triaged in-progress onleave finished cancelled + EncounterStatus (Required)
  statusHistory		0..*	BackboneElement	List of past encounter statuses
  status		1..1	code	planned arrived triaged in-progress onleave finished cancelled + EncounterStatus (Required)
  period		1..1	Period	The time that the episode was in the specified status
  class	Σ	1..1	Coding	Classification of patient encounter V3 Value SetActEncounterCode (Extensible)

 classHistory		0..*	BackboneElement	List of past encounter classes
  class		1..1	Coding	inpatient outpatient ambulatory emergency + V3 Value SetActEncounterCode (Extensible)
  period		1..1	Period	The time that the episode was in the specified class
  type	Σ	0..*	CodeableConcept	Specific type of encounter Encounter type (Example)
  serviceType	Σ	0..1	CodeableConcept	Specific type of service Service type (Example)
  priority		0..1	CodeableConcept	Indicates the urgency of the encounter v3 Code System ActPriority (Example)
  subject	Σ	0..1	Reference(Patient Group)	The patient or group present at the encounter
  episodeOfCare	Σ	0..*	Reference(EpisodeOfCare)	Episode(s) of care that this encounter should be recorded against
  basedOn		0..*	Reference(ServiceRequest)	The ServiceRequest that initiated this encounter
  participant	Σ	0..*	BackboneElement	List of participants involved in the encounter
  type	Σ	0..*	CodeableConcept	Role of participant in encounter Participant type (Extensible)
  period		0..1	Period	Period of time during the encounter that the participant participated
  individual	Σ	0..1	Reference(Practitioner PractitionerRole RelatedPerson)	Persons involved in the encounter other than the patient

 appointment	Σ	0..*	Reference(Appointment)	The appointment that scheduled this encounter
 period		0..1	Period	The start and end time of the encounter
 length		0..1	Duration	Quantity of time the encounter lasted (less time absent)
 reasonCode	Σ	0..*	CodeableConcept	Coded reason the encounter takes place Encounter Reason Codes (Preferred)
 reasonReference	Σ	0..*	Reference(Condition Procedure Observation Immunization Recommendation)	Reason the encounter takes place (reference)
 diagnosis	Σ	0..*	BackboneElement	The list of diagnosis relevant to this encounter
 condition	Σ	1..1	Reference(Condition Procedure)	The diagnosis or procedure relevant to the encounter
 use		0..1	CodeableConcept	Role that this diagnosis has within the encounter (e.g. admission, billing, discharge ...) DiagnosisRole (Preferred)
 rank		0..1	positiveInt	Ranking of the diagnosis (for each role type)
 account		0..*	Reference(Account)	The set of accounts that may be used for billing for this Encounter
 hospitalization		0..1	BackboneElement	Details about the admission to a healthcare service
 preAdmissionIdentifier		0..1	Identifier	Pre-admission identifier

	 origin	0..1	Reference(Location Organization)	The location/organization from which the patient came before admission
	 admitSource	0..1	CodeableConcept	From where patient was admitted (physician referral, transfer) Admit source (Preferred)
	 reAdmission	0..1	CodeableConcept	The type of hospital re-admission that has occurred (if any). If the value is absent, then this is not identified as a readmission v2 RE-ADMISSION INDICATOR (Example)
	 dietPreference	0..*	CodeableConcept	Diet preferences reported by the patient Diet (Example)
	 specialCourtesy	0..*	CodeableConcept	Special courtesies (VIP, board member) Special courtesy (Preferred)
	 specialArrangement	0..*	CodeableConcept	Wheelchair, translator, stretcher, etc. Special arrangements (Preferred)
	 destination	0..1	Reference(Location Organization)	Location/organization to which the patient is discharged
	 dischargeDisposition	0..1	CodeableConcept	Category or kind of location after discharge Discharge disposition (Example)
	 location	0..*	BackboneElement	List of locations where the patient has been
	 location	1..1	Reference(Location)	Location the encounter takes place
	 status	0..1	code	planned active reserved completed EncounterLocationStatus (Required)

 physicalType	0..1	CodeableConcept	The physical type of the location (usually the level in the location hierarchy - bed room ward etc.) Location type (Example)
 period	0..1	Period	Time period during which the patient was present at the location
 serviceProvider	0..1	Reference(Organization)	The organization (facility) responsible for this encounter
 partOf	0..1	Reference(Encounter)	Another Encounter this encounter is part of

13.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Encounter",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/encounter.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "vread"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "patch"
    },
    {
      "code": "delete"
    },
    {
      "code": "history-instance"
    },
    {
      "code": "history-type"
    },
    {
      "code": "search-type"
    }
  ]
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Encounter",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Identifier(s) by which this encounter is known  
  "status" : "<code>", // R! planned | arrived | triaged | in-progress | onleave | finished | cancelled +  
  "statusHistory" : [{ // List of past encounter statuses  
    "status" : "<code>", // R! planned | arrived | triaged | in-progress | onleave | finished | cancelled +  
    "period" : { Period } // R! The time that the episode was in the specified status  
  }],  
  "class" : { Coding }, // R! Classification of patient encounter  
  "classHistory" : [{ // List of past encounter classes  
    "class" : { Coding }, // R! inpatient | outpatient | ambulatory | emergency +  
    "period" : { Period } // R! The time that the episode was in the specified class  
  }],  
  "type" : [{ CodeableConcept }], // Specific type of encounter  
  "serviceType" : { CodeableConcept }, // Specific type of service  
  "priority" : { CodeableConcept }, // Indicates the urgency of the encounter  
  "subject" : { Reference(Patient|Group) }, // The patient or group present at the encounter  
  "episodeOfCare" : [{ Reference(EpisodeOfCare) }], // Episode(s) of care that this encounter should be recorded against  
  "basedOn" : [{ Reference(ServiceRequest) }], // The ServiceRequest that initiated this encounter  
  "participant" : [{ // List of participants involved in the encounter  
    "type" : [{ CodeableConcept }], // Role of participant in encounter  
    "period" : { Period }, // Period of time during the encounter that the participant participated  
    "individual" : { Reference(Practitioner|PractitionerRole|RelatedPerson) } // Persons involved in the encounter other than the patient  
  }],  
  "appointment" : [{ Reference(Appointment) }], // The appointment that scheduled this encounter  
  "period" : { Period }, // The start and end time of the encounter
```

```
"length" : { Duration }, // Quantity of time the encounter lasted (less time absent)
"reasonCode" : [{ CodeableConcept }], // Coded reason the encounter takes place
"reasonReference" : [{ Reference(Condition|Procedure|Observation|
ImmunizationRecommendation) }], // Reason the encounter takes place (reference)
"diagnosis" : [{ // The list of diagnosis relevant to this encounter
  "condition" : { Reference(Condition|Procedure) }, // R! The diagnosis or procedure relevant to
the encounter
  "use" : { CodeableConcept }, // Role that this diagnosis has within the encounter (e.g. admission,
  billing, discharge etc.)
  "rank" : "<positiveInt>" // Ranking of the diagnosis (for each role type)
}],
"account" : [{ Reference(Account) }], // The set of accounts that may be used for billing for this
Encounter
"hospitalization" : { // Details about the admission to a healthcare service
  "preAdmissionIdentifier" : { Identifier }, // Pre-admission identifier
  "origin" : { Reference(Location|Organization) }, // The location/organization from which the patient
came before admission
  "admitSource" : { CodeableConcept }, // From where patient was admitted (physician referral, transfer)
  "reAdmission" : { CodeableConcept }, // The type of hospital re-admission that has occurred (if
any). If the value is absent, then this is not identified as a readmission
  "dietPreference" : [{ CodeableConcept }], // Diet preferences reported by the patient
  "specialCourtesy" : [{ CodeableConcept }], // Special courtesies (VIP, board member)
  "specialArrangement" : [{ CodeableConcept }], // Wheelchair, translator, stretcher, etc.
  "destination" : { Reference(Location|Organization) }, // Location/organization to which the patient
is discharged
  "dischargeDisposition" : { CodeableConcept } // Category or kind of location after discharge
},
"location" : [{ // List of locations where the patient has been
  "location" : { Reference(Location) }, // R! Location the encounter takes place
  "status" : "<code>", // planned | active | reserved | completed
  "physicalType" : { CodeableConcept }, // The physical type of the location (usually the level in
the location hierarchy - bed room ward etc.)
  "period" : { Period } // Time period during which the patient was present at the location
}],
"serviceProvider" : { Reference(Organization) }, // The organization (facility) responsible for this
encounter
"partOf" : { Reference(Encounter) } // Another Encounter this encounter is part of
}
```

13.2.3 Terminology Bindings

Path	Definition	Type	Reference
Encounter.status	Current state of the encounter.	Required	EncounterStatus
Encounter.statusHistory.status			
Encounter.class	Classification of the encounter.	Extensible	v3.ActEncounterCode
Encounter.classHistory.class			
Encounter.type	The type of encounter.	Example	EncounterType
Encounter.serviceType	Broad categorization of the service that is to be provided.	Example	ServiceType
Encounter.priority	Indicates the urgency of the encounter.	Example	v3.ActPriority
Encounter.participant.type	Role of participant in encounter.	Extensible	ParticipantType
Encounter.reasonCode	Reason why the encounter takes place.	Preferred	EncounterReasonCodes
Encounter.diagnosis.use	The type of diagnosis this condition represents.	Preferred	DiagnosisRole
Encounter.hospitalization.admitSource	From where the patient was admitted.	Preferred	AdmitSource

Encounter.hospitalization.reAdmission	The reason for re-admission of this hospitalization encounter.	Example	v2.0092
Encounter.hospitalization.dietPreference	Medical, cultural or ethical food preferences to help with catering requirements.	Example	Diet
Encounter.hospitalization.specialCourtesy	Special courtesies.	Preferred	SpecialCourtesy
Encounter.hospitalization.specialArrangement	Special arrangements.	Preferred	SpecialArrangements
Encounter.hospitalization.dischargeDisposition	Discharge Disposition.	Example	DischargeDisposition
Encounter.location.status	The status of the location.	Required	EncounterLocationStatus
Encounter.location.physicalType	Physical form of the location.	Example	LocationType

13.2.4 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.

13.2.5 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.

13.2.6 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "class",
    "type": "token"
  },
  {
    "name": "_lastUpdated",
    "type": "date"
  },
  {
    "name": "status",
    "type": "token"
  },
  {
```

```
        "name": "service-provider",
        "type": "reference"
    },
{
    "name": "subject",
    "type": "reference"
},
{
    "name": "patient",
    "type": "reference"
},
{
    "name": "date",
    "type": "date"
},
{
    "name": "type",
    "type": "token"
},
{
    "name": "appointment",
    "type": "reference"
},
{
    "name": "diagnosis",
    "type": "reference"
},
{
    "name": "episodeofcare",
    "type": "reference"
},
{
    "name": "incomingreferral",
    "type": "reference"
},
{
    "name": "length",
    "type": "number"
},
{
    "name": "location",
    "type": "reference"
},
{
    "name": "location-period",
    "type": "date"
},
{
    "name": "part-of",
    "type": "reference"
},
{
    "name": "participant",
    "type": "reference"
},
{
    "name": "participant-type",
    "type": "token"
},
{
    "name": "practitioner",
    "type": "reference"
},
{
    "name": "special-arrangement",
    "type": "token"
},
```

```
{
  "name": "account",
  "type": "reference"
},
{
  "name": "based-on",
  "type": "reference"
},
{
  "name": "episode-of-care",
  "type": "reference"
},
{
  "name": "reason-code",
  "type": "token"
},
{
  "name": "reason-reference",
  "type": "reference"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
account	reference	The set of accounts that may be used for billing for this Encounter	Encounter.account (Account)	
appointment	reference	The appointment that scheduled this encounter	Encounter.appointment (Appointment)	
based-on	reference	The ServiceRequest that initiated this encounter	Encounter.basedOn (ServiceRequest)	
class	token	Classification of patient encounter	Encounter.class	
date	date	A date within the period the Encounter lasted	Encounter.period	17 Resources
diagnosis	reference	The diagnosis or procedure relevant to the encounter	Encounter.diagnosis.condition (Condition , Procedure)	

episode-of-care	reference	Episode(s) of care that this encounter should be recorded against	Encounter.episodeOfCare (EpisodeOfCare)	
identifier	token	Identifier(s) by which this encounter is known	Encounter.identifier	30 Resources
length	quantity	Length of encounter in days	Encounter.length	
location	reference	Location the encounter takes place	Encounter.location.location (Location)	
location-period	date	Time period during which the patient was present at the location	Encounter.location.period	
part-of	reference	Another Encounter this encounter is part of	Encounter.partOf (Encounter)	
participant	reference	Persons involved in the encounter other than the patient	Encounter.participant.individual (Practitioner , PractitionerRole , RelatedPerson)	
participant-type	token	Role of participant in encounter	Encounter.participant.type	
patient	reference	The patient or group present at the encounter	Encounter.subject.where(resolve() is Patient) (Patient)	33 Resources
practitioner	reference	Persons involved in the encounter other than the patient	Encounter.participant.individual.where(resolve() is Practitioner) (Practitioner)	

reason-code	token	Coded reason the encounter takes place	Encounter.reasonCode
reason-reference	reference	Reason the encounter takes place (reference)	Encounter.reasonReference (Condition , Observation , Procedure , ImmunizationRecommendation)
service-provider	reference	The organization (facility) responsible for this encounter	Encounter.serviceProvider (Organization)
special-arrangement	token	Wheelchair, translator, stretcher, etc.	Encounter.hospitalization.specialArrangement
status	token	planned arrived triaged in-progress onleave finished cancelled +	Encounter.status
subject	reference	The patient or group present at the encounter	Encounter.subject (Group , Patient)
type	token	Specific type of encounter	Encounter.type 5 Resources

13.2.7 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/encounter-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/encounter-definitions.html
Mappings	http://hl7.org/fhir/R4/encounter-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/encounter-profiles.html
Operations	http://hl7.org/fhir/R4/encounter-operations.html

14 Family Member History

Note: the following sections reference the FHIR standards version R4-
<http://hl7.org/fhir/R4/familymemberhistory.html>

Definition: Significant health conditions for a person related to the patient relevant in the context of care for the patient.

14.1 Scope and Usage

FamilyMemberHistory is one of the [event](#) resources in the FHIR [workflow](#) specification.

This resource records significant health 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](#) profile for an example.

The entire family history for an individual can be represented by combining references to **FamilyMemberHistory** instances into a [List](#) resource instance.

14.2 Resource Content

14.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Name	Flags	Card.	Type	Description & Constraints 
 Family Member History	 ITU		DomainResource	<p>Information about patient's relatives, relevant for patient</p> <p>+ Rule: <i>Can have age[x] or born[x], but not both</i></p> <p>+ Rule: <i>Can only have estimatedAge if age[x] is present</i></p> <p>Elements defined in</p> <p>Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
 identifier	 Σ	0..*	Identifier	External Id(s) for this record
 instantiatesCanonical	 Σ	0..*	canonical(PlanDefinition Questionnaire ActivityDefinition Measure Operation Definition)	Instantiates FHIR protocol or definition
 instantiatesUri	 Σ	0..*	uri	Instantiates external protocol or definition
 status	 Σ	1..1	code	partial completed entered-in-error health-unknown FamilyHistoryStatus (Required)

	Σ	0..1	CodeableConcept	subject-unknown withheld unable-to-obtain deferred FamilyHistoryAbsentReason (Example)
 dataAbse	Σ			
 patient	Σ	1..1	Reference(Patient)	Patient history is about
 date	Σ	0..1	dateTime	When history was recorded or last updated
 name	Σ	0..1	string	The family member described
	Σ	1..1	CodeableConcept	Relationship to the subject V3 Value SetFamilyMember (Example)
 relationshp	Σ			
 sex	Σ	0..1	CodeableConcept	male female other unknown AdministrativeGender (Extensible)
	I	0..1		(approximate) date of birth
 born[x]				
 bornPerio			Period	
 bornDate			date	
 bornString			string	
 age[x]	ΣI	0..1		(approximate) age
 ageAge			Age	
 ageRange			Range	
 ageString			string	

 estimated	Σ	0..1	boolean	Age is estimated?
 deceased	Σ	0..1		Dead? How old/when?
 deceased			boolean	
 deceased				Boolean
 deceased			Age	
 deceased			Range	
 deceased			date	
 deceased			string	
 reasonCode	Σ	0..*	CodeableConcept	Why was family member history performed? SNOMED CT Clinical Findings (Example)
 reasonRef	Σ	0..*	Reference(Condition Observation AllergyIntolerance QuestionnaireResponse DiagnosticReport DocumentReference)	Why was family member history performed?
 note		0..*	Annotation	General note about related person

	0..*	BackboneElement	Condition that the related person had
 condition	1..1	CodeableConcept	Condition suffered by relation Condition/Problem/Diagnosis Codes (Example)
 code	0..1	CodeableConcept	deceased permanent disability etc. Condition Outcome Codes (Example)
 outcome	0..1	boolean	Whether the condition contributed to the cause of death
 contributedToDeath	0..1		When condition first manifested
 onset[x]		Age	
 onsetAge		Range	
 onsetRange		Period	
 onsetString		string	
 note	0..*	Annotation	Extra information about condition

14.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
  "type": "FamilyMemberHistory",  
  "profile": {  
    "reference": "http://hl7.org/fhir/R4/familymemberhistory.html"  
  },  
  "interaction": [  
    "view": "FamilyMemberHistory",  
    "resource": "Patient",  
    "profile": "http://hl7.org/fhir/R4/StructureDefinition/  
    Patient",  
    "order": 1  
  ]  
}
```

```
{  
    "code": "read",  
    "documentation": "Read the current state of the resource"  
},  
{  
    "code": "create",  
    "documentation": "Create a new resource with a server assigned id"  
},  
{  
    "code": "update",  
    "documentation": "Update an existing resource by its id"  
},  
{  
    "code": "delete",  
    "documentation": "Delete a resource"  
},  
{  
    "code": "vread",  
    "documentation": "Read the state of a specific version of the resource"  
},  
{  
    "code": "patch"  
},  
{  
    "code": "history-instance",  
    "documentation": "Retrieve the change history for a particular resource."  
},  
{  
    "code": "history-type",  
    "documentation": "Retrieve the change history for all resources of a  
particular type"  
},  
{  
    "code": "search-type",  
    "documentation": "Search the resource type based on some filter criteria"  
}  
],
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "FamilyMemberHistory",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // External Id(s) for this record  
  "instantiatesCanonical" : [{ canonical(PlanDefinition|Questionnaire|ActivityDefinition|Measure|OperationDefinition) }], // Instantiates FHIR protocol or definition  
  "instantiatesUri" : ["<uri>"], // Instantiates external protocol or definition  
  "status" : "<code>", // R! partial | completed | entered-in-error | health-unknown
```

```
"dataAbsentReason" : { CodeableConcept }, // subject-unknown | withheld | unable-to-obtain | deferred  
"patient" : { Reference(Patient) }, // R! Patient history is about  
"date" : "<dateTime>", // When history was recorded or last updated  
"name" : "<string>", // The family member described  
"relationship" : { CodeableConcept }, // R! Relationship to the subject  
"sex" : { CodeableConcept }, // male | female | other | unknown  
// born[x]: (approximate) date of birth. One of these 3:  
"bornPeriod" : { Period },  
"bornDate" : "<date>",  
"bornString" : "<string>",  
// age[x]: (approximate) age. One of these 3:  
"ageAge" : { Age },  
"ageRange" : { Range },  
"ageString" : "<string>",  
"estimatedAge" : <boolean>, // C? Age is estimated?  
// deceased[x]: Dead? How old/when?. One of these 5:  
"deceasedBoolean" : <boolean>,  
"deceasedAge" : { Age },  
"deceasedRange" : { Range },  
"deceasedDate" : "<date>",  
"deceasedString" : "<string>",  
"reasonCode" : [{ CodeableConcept }], // Why was family member history performed?  
"reasonReference" : [{ Reference(Condition|Observation|AllergyIntolerance|QuestionnaireResponse|DiagnosticReport|DocumentReference) }], // Why was family member history performed?  
"note" : [{ Annotation }], // General note about related person  
"condition" : [{ // Condition that the related person had  
  "code" : { CodeableConcept }, // R! Condition suffered by relation  
  "outcome" : { CodeableConcept }, // deceased | permanent disability | etc.  
  "contributedToDeath" : <boolean>, // Whether the condition contributed to the cause of death  
// onset[x]: When condition first manifested. One of these 4:  
  "onsetAge" : { Age },  
  "onsetRange" : { Range },  
  "onsetPeriod" : { Period },  
  "onsetString" : "<string>",
```

```
"note" : [{ Annotation }] // Extra information about condition  
}  
}
```

14.2.3 Terminology Bindings

Path	Definition	Type	Reference
FamilyMemberHistory.status	A code that identifies the status of the family history record.	Required	FamilyHistoryStatus
FamilyMemberHistory.dataAbsentReason	Codes describing the reason why a family member's history is not available.	Example	FamilyHistoryAbsentReason
FamilyMemberHistory.relationship	The nature of the relationship between the patient and the related person being described in the family member history.	Example	v3.FamilyMember
FamilyMemberHistory.sex	Codes describing	Extensible	AdministrativeGender

	the sex assigned at birth as documented on the birth registration.		
FamilyMemberHistory.reasonCode	Codes indicating why the family member history was done.	Example	SNOMEDCTClinicalFindings
FamilyMemberHistory.condition.code	Identification of the Condition or diagnosis.	Example	Condition/Problem/DiagnosisCodes
FamilyMemberHistory.condition.outcome	The result of the condition for the patient; e.g. death, permanent disability, temporary disability, etc.	Example	ConditionOutcomeCodes

14.2.4. Constraints

id	Level	Location	Description	Expression
fhs-1	Rule	(base)	Can have age[x] or born[x], but not both	age.empty() or born.empty()

fhs-2	Rule	(base)	Can only have estimatedAge if age[x] is present	age.exists() or estimatedAge.empty()
--------------	----------------------	--------	---	--------------------------------------

14.2.5 Processing information about the Family Member History

The Family Member History [List](#) may contain other than FamilyMemberHistory resources. For example, a full Family History could be a [List](#) that might include a mixture of FamilyMemberHistory records as well as [Observation](#) records of things like "maternal family history of breast cancer", "number of siblings", "number of female family members with breast cancer" etc.

The [List](#) representing a patient's "family history" can include [Condition](#) and [Observation](#) records that capture "family-history" relevant assertions about the patient themselves that would typically be captured as part of a family history.

14.2.6 No Known Patient History, No Known Problems, and Negated Conditions

Not Reviewed, Not Asked

When a sending system does not have family history about any family members or the statement is about family history not yet being asked, then the [List](#) resource should be used to indicate the List.emptyReason="notasked".

Reviewed, None Identified for Family

After reasonable investigation that there are no known items for the family member history list, then the [List](#) resource should be used to indicate the List.emptyReason="nilknown". The List.emptyReason represents a statement about the full scope of the list (i.e. the patient or patient's agent/guardian has asserted that there are no conditions or significant events for any family members to record).

Reviewed, None Identified for a Family Member

When an individual family member's history is not available, FamilyMemberHistory.dataAbsentReason can be used to indicate why that family member's history is not available (e.g. subject unknown).

Reviewed, No Known Problems or Negated Condition for a Family Member

The FamilyMemberHistory.condition.code can be used to capture "No Known Problems" or negated conditions, such as "No history of malignant tumor of breast", for an individual family member.

14.2.7 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "status",
    "type": "token"
  },
  {
    "name": "gender",
    "type": "token"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "_lastUpdated",
    "type": "date"
  },
  {
    "name": "code",
    "type": "token"
  },
  {
    "name": "date",
    "type": "date"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "definition",
    "type": "reference"
  },
  {
    "name": "relationship",
    "type": "token"
  },
  {
    "name": "instantiates-canonical",
    "type": "reference"
  },
  {
    "name": "instantiates-uri",
    "type": "uri"
  },
  {
    "name": "sex",
    "type": "token"
  }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
identifier	token	A search by a record identifier	FamilyMemberHistory.identifier	30 Resources

instantiate	referenc	Instantiates FHIR FamilyMemberHistory.instantiatesCanonical	
s-canonical	e	protocol or definition	(Questionnaire , Measure , PlanDefinition , OperationDefinition , ActivityDefinition)
instantiate	uri	Instantiates external protocol or definition	FamilyMemberHistory.instantiatesUri
patient	referenc	The identity of a family member history items for	33 Resources
	e	subject to list	(Patient)
sex	token	A search by a sex code of a family member	FamilyMemberHistory.sex
status	token	partial completed entered-in-error health-unknown	FamilyMemberHistory.status

14.2.8 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/familymemberhistory-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/familymemberhistory-definitions.html
Mappings	http://hl7.org/fhir/R4/familymemberhistory-mappings.html

Profiles & Extensions	http://hl7.org/fhir/R4/familymemberhistory-profiles.html
----------------------------------	---

15 Flag

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/flag.html>

Definition: Prospective warnings of potential issues when providing care to the patient.

15.1 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 involved in patient care. It usually represents something of sufficient significance to 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](#))
- Known adverse reaction to a substance (use [AllergyIntolerance](#))

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.

15.1.2 Boundaries and Relationships

Flags may highlight a highly condensed view of information found in the [AllergyIntolerance](#), [Condition](#), [Observation](#), [Procedure](#) and possibly other resources. A [common extension](#) 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](#) and the [Communication](#) 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](#).

15.2 Resource Content

15.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Fl	C	Type	Description & Constraints
 Flag	 Flag	 Flag	DomainResource	Key information to flag to healthcare providers
 Flag	 Flag	 Flag		Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 Identifier	 Identifier	 Identifier	Identifier	Business identifier
 FlagStatus	 FlagStatus	 FlagStatus	code	active inactive entered-in-error FlagStatus (Required)
 Category	 Category	 Category	CodeableConcept	Clinical, administrative, etc. Flag Category (Example)

 cod	Σ	1.	CodeableConcept	Coded or textual message to display to user Flag Code (Example)
 sub	Σ	1.	Reference(Patient Location Group Organization Practitioner PlanDefinition Medication Procedure)	Who/What is flag about?
 peri	Σ	0.	Period	Time period when flag is active
 enc	Σ	0.	Reference(Encounter)	Alert relevant during encounter
 aut	Σ	0.	Reference(Device Organization Patient Practitioner PractitionerRole)	Flag creator

15.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Flag",
  "profile": {
    "reference": "http://www.hl7.org/fhir/Flag.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "vread"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance"
    }
  ]
}
```

```
{  
  "code": "history-type"  
},  
{  
  "code": "search-type"  
}  
],
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Flag",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Business identifier  
  "status" : "<code>", // R! active | inactive | entered-in-error  
  "category" : [{ CodeableConcept }], // Clinical, administrative, etc.  
  "code" : { CodeableConcept }, // R! Coded or textual message to display to user  
  "subject" : { Reference(Patient|Location|Group|Organization|Practitioner|PlanDefinition|Medication|Procedure) }, // R! Who/What is flag about?  
  "period" : { Period }, // Time period when flag is active  
  "encounter" : { Reference(Encounter) }, // Alert relevant during encounter  
  "author" : { Reference(Device|Organization|Patient|Practitioner|PractitionerRole) } // Flag creator  
}
```

15.2.3 Terminology Bindings

Path	Definition	Type	Reference
Flag.status	Indicates whether this flag is active and needs to be displayed to a user, or whether it is no longer needed or was entered in error.	Required	FlagStatus
Flag.category	A general category for flags for filtering/display purposes.	Example	FlagCategory

Flag.code	Detail codes identifying specific flagged issues.	Example	FlagCode
-----------	---	-------------------------	--------------------------

15.2.4 Notes

The Flag resource is sometimes used 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)

15.2.5 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "author",
    "type": "reference"
  },
  {
    "name": "date",
    "type": "date"
  },
  {
    "name": "encounter",
    "type": "reference"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "subject",
    "type": "reference"
  }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
author	reference	Flag creator	Flag.author (Practitioner , Organization , Device , Patient , PractitionerRole)	

date	date	Time period when flag is active	Flag.period	17 Resources
identifier	token	Business identifier	Flag.identifier	
patient	reference	The identity of a subject to list flags for	Flag.subject.where(resolve() is Patient)	33 Resources

15.2.6 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/flag-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/flag-definitions.html
Mappings	http://hl7.org/fhir/R4/flag-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/flag-profiles.html

16 Healthcare Service

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/healthcareservice.html>

Definition: The details of a healthcare service available at a location.

16.1 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.

16.1.1 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.

The HealthcareService resource is used with the following resources:

- **[Organization](#)**: The organization provides the services, the healthcareservice describes the services
- **[ServiceRequest](#)**: This is a subject specific request for a specific service, it may be to a specific healthcare service, and/or simply a coded service value. The granularity included in the request codes may be finer than defined in the healthcare service.
- **[OrganizationAffiliation](#)**: Might constrain a list of healthcare services that are available between 2 organizations
- **[Location](#)**: Specifies the place where the service(s) are offered/available within.

16.2 Resource Content

16.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

<u>Name</u>	<u>Fla gs</u>	<u>Car d.</u>	<u>Type</u>	<u>Description & Constraints</u> 
 HealthcareService	TU		DomainResource	The details of a healthcare service available at a location Elements defined in Ancestors: id , meta , implicitRules , language , text , contain extension , modifierExtension
 identifier	Σ	0.. *	Identifier	External identifiers for this item
 active	$?!\Sigma$	0.. 1	boolean	Whether this HealthcareService record is in active use

 providedBy	Σ	0.. 1	Reference(Organization)	Organization that provides this service
 category	Σ	0.. *	CodeableConcept	Broad category of service being performed or delivered Service category (Example)
 type	Σ	0.. *	CodeableConcept	Type of service that may be delivered or performed Service type (Example)
 specialty	Σ	0.. *	CodeableConcept	Specialties handled by the HealthcareService Practice Setting Code Value Set (Preferred)
 location	Σ	0.. *	Reference(Location)	Location(s) where service may be provided
 name	Σ	0.. 1	string	Description of service as presented to a consumer while searching
 comment	Σ	0.. 1	string	Additional description and/or any specific issues not covered elsewhere
 coverageArea		0.. *	Reference(Location)	Location(s) service is intended for/available to
 eligibility		0.. *	BackboneElement	Specific eligibility requirements required to use the service
 code		0.. 1	CodeableConcept	Coded value for the eligibility pt
 comment		0.. 1	markdown	Describes the eligibility conditions for the service
 program		0.. *	CodeableConcept	Programs that this service is applicable to Program (Example)
 characteristic		0.. *	CodeableConcept	Collection of characteristics (attributes) pt
 communication		0.. *	CodeableConcept	The language that this service is offered in Common Languages (Preferred) but limited to AllLanguages

	0..	BackboneElement	Times the Service Site is available
└── availableTime	*	nt	
└── daysOfWeek	0..	code	mon tue wed thu fri sat sun
└── allDay	1	boolean	DaysOfWeek (Required)
	0..	time	Always available? e.g. 24 hour service
└── availableStart	1	time	Opening time of day (ignored if allDay = true)
Time			
└── availableEndTi	1	time	Closing time of day (ignored if allDay = true)
└── me			
	0..	string	Description of availability exceptions
└── availabilityExc	1	ptions	
└── endpoint	0..	Reference(Endp	Technical endpoints providing access to electronic services
	*	oint)	operated for the healthcare s

16.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "HealthcareService",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/healthcareservice.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    }
  ]
}
```

```
        },
        {
            "code": "vread",
            "documentation": "Read the state of a specific version of the resource"
        },
        {
            "code": "patch"
        },
        {
            "code": "history-instance",
            "documentation": "Retrieve the change history for a particular resource."
        },
        {
            "code": "history-type",
            "documentation": "Retrieve the change history for all resources of a
particular type"
        },
        {
            "code": "search-type",
            "documentation": "Search the resource type based on some filter criteria"
        }
    ],
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "HealthcareService",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // External identifiers for this item  
  "active" : <boolean>, // Whether this HealthcareService record is in active use  
  "providedBy" : { Reference(Organization) }, // Organization that provides this service  
  "category" : [{ CodeableConcept }], // Broad category of service being performed or delivered  
  "type" : [{ CodeableConcept }], // Type of service that may be delivered or performed  
  "specialty" : [{ CodeableConcept }], // Specialties handled by the HealthcareService  
  "location" : [{ Reference(Location) }], // Location(s) where service may be provided  
  "name" : "<string>", // Description of service as presented to a consumer while searching  
  "comment" : "<string>", // Additional description and/or any specific issues not covered elsewhere  
  "extraDetails" : "<markdown>", // Extra details about the service that can't be placed in the other fields  
  "photo" : { Attachment }, // Facilitates quick identification of the service  
  "telecom" : [{ ContactPoint }], // Contacts related to the healthcare service  
  "coverageArea" : [{ Reference(Location) }], // Location(s) service is intended for/available to
```

```
"serviceProvisionCode" : [{ CodeableConcept }], // Conditions under which service is available/offered
"eligibility" : [{ // Specific eligibility requirements required to use the service
  "code" : { CodeableConcept }, // Coded value for the eligibility
  "comment" : "<markdowm>" // Describes the eligibility conditions for the service
}],
"program" : [{ CodeableConcept }], // Programs that this service is applicable to
"characteristic" : [{ CodeableConcept }], // Collection of characteristics (attributes)
"communication" : [{ CodeableConcept }], // The language that this service is offered in
"referralMethod" : [{ CodeableConcept }], // Ways that the service accepts referrals
"appointmentRequired" : <boolean>, // If an appointment is required for access to this service
"availableTime" : [{ // Times the Service Site is available
  "daysOfWeek" : ["<code>"], // mon | tue | wed | thu | fri | sat | sun
  "allDay" : <boolean>, // Always available? e.g. 24 hour service
  "availableStartTime" : "<time>", // Opening time of day (ignored if allDay = true)
  "availableEndTime" : "<time>" // Closing time of day (ignored if allDay = true)
}],
"notAvailable" : [{ // Not available during this time due to provided reason
  "description" : "<string>", // R! Reason presented to the user explaining why time not available
  "during" : { Period } // Service not available from this date
}],
"availabilityExceptions" : "<string>", // Description of availability exceptions
"endpoint" : [{ Reference(Endpoint) }] // Technical endpoints providing access to electronic services operated for the healthcare service
}
```

16.2.3 Terminology Bindings

Path	Definition	Type	Reference
HealthcareService.category	A category of the service(s) that could be provided.	Example	ServiceCategory
HealthcareService.type	Additional details about where the content was created (e.g. clinical specialty).	Example	ServiceType
HealthcareService.specialty	A specialty that a healthcare service may provide.	Preferred	PracticeSettingCodeValue Set
HealthcareService.serviceProvisionCode	The code(s) that detail the conditions under which the healthcare service is available/offered .	Example	ServiceProvisionCondition S
HealthcareService.eligibility.code	Coded values underwhich a specific service is made available.	Unknown	No details provided yet

HealthcareService.program	Government or local programs that this service applies to.	Example	Program
HealthcareService.characteristic	A custom attribute that could be provided at a service (e.g. Wheelchair accessibility).	Unknown	No details provided yet
HealthcareService.communication	A human language.	Preferred , but limited to AllLanguages	CommonLanguages
HealthcareService.referralMethod	The methods of referral can be used when referring to a specific HealthCareService resource.	Example	ReferralMethod
HealthcareService.availableTime.daysOfWeek	The days of the week.	Required	DaysOfWeek

16.2.4 Notes:

- The HealthcareService could be mapped to components of the IHE Care Services Directory, and/or the OMG ServD standards

16.2.5 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
    {
        "name": "active",
        "type": "token"
    },
    {
        "name": "characteristic",
        "type": "token"
    },
    {
        "name": "coverage-area",
        "type": "reference"
    },
    {
        "name": "endpoint",
        "type": "reference"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "location",
        "type": "reference"
    },
    {
        "name": "name",
        "type": "string"
    },
    {
        "name": "organization",
        "type": "reference"
    },
    {
        "name": "program",
        "type": "string"
    },
    {
        "name": "service-category",
        "type": "token"
    },
    {
        "name": "service-type",
        "type": "token"
    },
    {
        "name": "specialty",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	The Healthcare Service is currently marked as active	HealthcareService.active	
characteristic	token	One of the HealthcareService's characteristics	HealthcareService.characteristic	
coverage-area	reference	Location(s) service is intended for/available to	HealthcareService.coverageArea(Location)	
endpoint	reference	Technical endpoints providing access to electronic services operated for the healthcare service	HealthcareService.endpoint(Endpoint)	
identifier	token	External identifiers for this item	HealthcareService.identifier	
location	reference	The location of the Healthcare Service	HealthcareService.location(Location)	
name	string	A portion of the Healthcare service name	HealthcareService.name	
organization	reference	The organization that provides this Healthcare Service	HealthcareService.providedBy(Organization)	
program	token	One of the Programs supported by this HealthcareService	HealthcareService.program	
service-category	token	Service Category of the Healthcare Service	HealthcareService.category	
service-type	token	The type of service provided by this healthcare service	HealthcareService.type	

specialty	token	The specialty of the service provided by this healthcare service	HealthcareService.specialty
-----------	-----------------------	--	-----------------------------

16.2.6 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/healthcareservice-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/healthcareservice-definitions.html
Mappings	http://hl7.org/fhir/R4/healthcareservice-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/healthcareservice-profiles.html

17 Imaging Study

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/imagingstudy.html>

Representation of the content produced in a DICOM imaging study. A study comprises a set of series, each of which includes a set of Service-Object Pair Instances (SOP Instances - images or other data) acquired or produced in a common context. A series is of only one modality (e.g. X-ray, CT, MR, ultrasound), but a study may have multiple series of different modalities.

17.1 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](#). 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](#). Attributes used in the DICOM query information models, such as "Number of Instances in Study", can be found in [DICOM Part 4 Annex 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.

An ImagingStudy SHALL reference one DICOM Study, and MAY reference a subset of that Study. More than one ImagingStudy MAY reference the same DICOM Study or different subsets of the same DICOM Study.

17.1.1 Boundaries and Relationships

ImagingStudy is used for DICOM imaging and associated information. Use [Media](#) to track non-DICOM images, video, or audio. [Binary](#) can be used to store arbitrary content. [DocumentReference](#) allow indexing and retrieval of clinical "documents" with relevant metadata.

17.2 Resource Content

17.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 ImagingStudy	TU		Domain Resource	A set of images produced in single study (one or more series of references images) Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension

 identifier	Σ	0..*	Identifier	Identifiers for the whole study
 status	$?\Sigma$	1..1	code	registered available cancelled entered-in-error unknown ImagingStudyStatus (Required)
 modality	Σ	0..*	Coding	All series modality if actual acquisition modalities AcquisitionModality ↗ (Extensible)
 subject	Σ	1..1	Reference(Patient Device Group)	Who or what is the subject of the study
 encounter	Σ	0..1	Reference(Encounter)	Encounter with which this imaging study is associated
 started	Σ	0..1	dateTime	When the study was started
 basedOn	Σ	0..*	Reference(CarePlan ServiceRequest Appointment AppointmentResponse Task)	Request fulfilled
 referrer	Σ	0..1	Reference(Practitioner PractitionerRole)	Referring physician
 interpreter	Σ	0..*	Reference(Practitioner PractitionerRole)	Who interpreted images
 endpoint	Σ	0..*	Reference(Endpoint)	Study access endpoint
 numberOfSeries	Σ	0..1	unsignedInt	Number of Study Related Series
 numberOfInstances	Σ	0..1	unsignedInt	Number of Study Related Instances

 procedure	Σ	0..1	Reference(Procedure)	The performed Procedure reference
 procedure	Σ	0..*	CodeableConcept	The performed procedure code ImagingProcedureCode 
 location	Σ	0..1	Reference(Location)	Where ImagingStudy occurred
 reasonCode	Σ	0..*	CodeableConcept	Why the study was requested Procedure Reason Codes 
 reasonReference	Σ	0..*	Reference(Condition) Observation Media DiagnosticReport DocumentReference	Why was study performed
 note	Σ	0..*	Annotation	User-defined comments
 description	Σ	0..1	string	Institution-generated description
 series	Σ	0..*	BackboneElement	Each study has one or more series of instances
 uid	Σ	1..1	id	DICOM Series Instance UID for the series
 number	Σ	0..1	unsignedInt	Numeric identifier of this series
 modality	Σ	1..1	Coding	The modality of the instances in the series AcquisitionModality 
 description	Σ	0..1	string	A short human readable summary of the series
 numberOfInstances	Σ	0..1	unsignedInt	Number of Series Related Instances

				Series access endpoint
endpoint	Σ	0..*	Reference(Endpoint)	
bodySite	Σ	0..1	Coding	Body part examined SNOMED CT Body Structures (Example)
laterality	Σ	0..1	Coding	Body part laterality Laterality (Example)
specimen	Σ	0..*	Reference(Specimen)	Specimen imaged
started	Σ	0..1	dateTime	When the series started
performer	Σ	0..*	BackboneElement	Who performed the series
function	Σ	0..1	CodeableConcept	Type of performance ImagingStudy series performer function (Extensible)
actor	Σ	1..1	Reference(Practitioner PractitionerRole Organization CareTeam Patient Device RelatedPerson)	Who performed the series
instance		0..*	BackboneElement	A single SOP instance from the series
uid		1..1	id	DICOM SOP Instance UID
sopClass		1..1	Coding	DICOM class type sopClass ↗ (Extensible)
number		0..1	unsignedInt	The number of this instance in the series
title		0..1	string	Description of instance

17.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
"searchParam": [  
    {  
        "name": "basedon",  
        "type": "reference"  
    },  
    {  
        "name": "bodysite",  
        "type": "token"  
    },  
    {  
        "name": "dicom-class",  
        "type": "token"  
    },  
    {  
        "name": "encounter",  
        "type": "reference"  
    },  
    {  
        "name": "endpoint",  
        "type": "reference"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    },  
    {  
        "name": "instance",  
        "type": "token"  
    },  
    {  
        "name": "interpreter",  
        "type": "reference"  
    },  
    {  
        "name": "modality",  
        "type": "token"  
    },  
    {  
        "name": "patient",  
        "type": "reference"  
    },  
    {  
        "name": "performer",  
        "type": "reference"  
    },  
    {  
        "name": "reason",  
        "type": "token"  
    },  
    {  
        "name": "referrer",  
        "type": "reference"  
    },  
    {  
        "name": "series",  
        "type": "token"  
    },  
    {  
        "name": "started",  
        "type": "date"  
    },  
]
```

```
{  
  "name": "status",  
  "type": "token"  
},  
{  
  "name": "subject",  
  "type": "reference"  
}  
]
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{  
  ?  
  "resourceType" : "ImagingStudy",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Identifiers for the whole study  
  "status" : "<code>", // R! registered | available | cancelled | entered-in-error | unknown  
  "modality" : [{ Coding }], // All series modality if actual acquisition modalities ↗  
  "subject" : { Reference(Patient|Device|Group) }, // R! Who or what is the subject of the study  
  "encounter" : { Reference(Encounter) }, // Encounter with which this imaging study is associated  
  "started" : "<dateTime>", // When the study was started  
  "basedOn" : [{ Reference(CarePlan|ServiceRequest|Appointment|  
    AppointmentResponse|Task) }], // Request fulfilled  
  "referrer" : { Reference(Practitioner|PractitionerRole) }, // Referring physician  
  "interpreter" : [{ Reference(Practitioner|PractitionerRole) }], // Who interpreted images  
  "endpoint" : [{ Reference(Endpoint) }], // Study access endpoint  
  "numberOfSeries" : "<unsignedInt>", // Number of Study Related Series  
  "numberOfInstances" : "<unsignedInt>", // Number of Study Related Instances  
  "procedureReference" : { Reference(Procedure) }, // The performed Procedure reference  
  "procedureCode" : [{ CodeableConcept }], // The performed procedure code ↗  
  "location" : { Reference(Location) }, // Where ImagingStudy occurred  
  "reasonCode" : [{ CodeableConcept }], // Why the study was requested  
  "reasonReference" : [{ Reference(Condition|Observation|Media|  
    DiagnosticReport|DocumentReference) }], // Why was study performed  
  "note" : [{ Annotation }], // User-defined comments  
  "description" : "<string>", // Institution-generated description
```

```
"series" : [{ // Each study has one or more series of instances
  "uid" : "<id>", // R! DICOM Series Instance UID for the series
  "number" : "<unsignedInt>", // Numeric identifier of this series
  "modality" : { Coding }, // R! The modality of the instances in the series ↗
  "description" : "<string>", // A short human readable summary of the series
  "numberOfInstances" : "<unsignedInt>", // Number of Series Related Instances
  "endpoint" : [{ Reference(Endpoint) }], // Series access endpoint
  "bodySite" : { Coding }, // Body part examined
  "laterality" : { Coding }, // Body part laterality
  "specimen" : [{ Reference(Specimen) }], // Specimen imaged
  "started" : "<dateTime>", // When the series started
  "performer" : [{ // Who performed the series
    "function" : { CodeableConcept }, // Type of performance
    "actor" : { Reference(Practitioner|PractitionerRole|Organization|CareTeam|
      Patient|Device|RelatedPerson) } // R! Who performed the series
  }],
  "instance" : [{ // A single SOP instance from the series
    "uid" : "<id>", // R! DICOM SOP Instance UID
    "sopClass" : { Coding }, // R! DICOM class type ↗
    "number" : "<unsignedInt>", // The number of this instance in the series
    "title" : "<string>" // Description of instance
  }]
}
}
```

17.2.3 Terminology Bindings

Path	Definition	Type	Reference
ImagingStudy.status	The status of the ImagingStudy.	Required	ImagingStudyStatus
ImagingStudy.modality	Type of acquired data in the instance.	Extensible	AcquisitionModality
ImagingStudy.series.modality			↗
ImagingStudy.procedureCode	The performed procedure type.	Extensible	http://www.rsna.org/RadLex_Playbook.aspx
ImagingStudy.reasonCode	The reason for the study.	Example	ProcedureReasonCodes
ImagingStudy.series.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMEDCTBodyStructures
ImagingStudy.series.laterality	Codes describing body site laterality (left, right, etc.).	Example	Laterality
ImagingStudy.series.performer.function	The type of involvement of the performer.	Extensible	ImagingStudySeriesPerformerFunction
ImagingStudy.series.instance.sopClass	The sopClass for the instance.	Extensible	http://dicom.nema.org/medical/dicom/current/output/chtml/part04/sect_B.5.html#table_B.5-1

17.2.4 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 “of interest” images, or instances to be “deleted”; or
- Other DICOM content.

DICOM Series Instance UID and SOP Instance UID use the `id` datatype, and are encoded directly. For example, an image with SOP Instance UID

of `2.16.124.113543.1154777499.30246.19789.3503430045.1.1` is encoded

in `ImagingStudy.series.instance.uid` as “`2.16.124.113543.1154777499.30246.19789.3503430045.1.1`”.

The ImagingStudy’s DICOM Study Instance UID is encoded in the `ImagingStudy.identifier` element, which is of the `Identifier` datatype. When encoding a DICOM UID in an `Identifier` datatype, use the Identifier system of “`urn:dicom:uid`”, and prefix the UID value with “`urn:oid:`”. Therefore, an ImagingStudy with DICOM Study Instance UID

of `2.16.124.113543.1154777499.30246.19789.3503430046` is encoded as:

```
"identifier":{  
    "system":"urn:dicom:uid",  
    "value":"urn:oid:2.16.124.113543.1154777499.30246.19789.3503430046"  
}
```

The study accession number can also be encoded as an `Identifier` using the “`ACSN`” identifier type, as follows:

```
"identifier":{  
    "type" : {  
        "coding" : [  
            {  
                "system" : "http://terminology.hl7.org/CodeSystem/v  
2-0203",  
                "code" : "ACSN"  
            }  
        ]  
    },  
    "system":"http://ginormoushospital.org/acquisition",
```

```
        "value": "GH334103"  
    }  
}
```

The ImagingStudy.endpoint elements and ImagingStudy.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 ImagingStudy.series.endpoint of a particular Endpoint.connectionType provides that service for that series, and all contained instances. An ImagingStudy.endpoint of a particular connection 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 ImagingStudy.series.endpoint overrides an ImagingStudy.endpoint of the same connection type. Systems can determine if a particular study, series, or instance is available or offline by interacting with the endpoint. 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.address` may require manipulation. See below for the details on use of imaging-related Endpoint connection types.

17.2.4.1 WADO-RS

An `Endpoint.connectionType` of code `dicom-wado-rs`, system <http://terminology.h17.org/CodeSystem/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 “rendered” 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 “single frame,” “multi-frame,” “video,” “text,” or “other.” 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, using the following information in a fictional ImagingStudy resource:

- the WADO-RS service base url of “<https://pacs.hospital.org/wado-rs>” found in an `ImagingStudy.endpoint.address`,
- the DICOM Study Instance UID of “`1.2.250.1.59.40211.12345678.678910`” found in an `ImagingStudy.identifier` having `Identifier.system` of “`urn:dicom:uid`”,
- the DICOM Series Instance UID of “`1.2.250.1.59.40211.789001276.14556172.67789`” found in `ImagingStudy.series.uid`, and
- the DICOM SOP Instance UID of “`1.2.250.1.59.40211.2678810.87991027.899772.2`” found in `ImagingStudy.series.instance.uid`

we can construct the WADO-RS URL to issue an HTTP GET for a native DICOM PS3.10 instance file (if consistent with the Accept header):

```
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 "burn" 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/render?viewport=100,100,0,0,1000,3000
```

For further details on DICOM WADO-RS capabilities including additional rendering parameters, see [DICOM PS 3.18](#).

17.2.4.2 WADO-URI

An `Endpoint.connectionType` of code `dicom-wado-uri`, system `http://terminology.hl7.org/CodeSystem/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 question 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 "rendered" 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 "single frame," "multi-frame," "video," "text," or "other."

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

For example, using the following information in a fictional `ImagingStudy` resource:

- the WADO-URI service base url of "<https://pacs.hospital.org/wado-uri>" found in an `ImagingStudy.endpoint.address`,
- the DICOM Study Instance UID of `1.2.250.1.59.40211.12345678.678910` found in an `ImagingStudy.identifier` having `Identifier.system` of "`urn:dicom:uid`",
- the DICOM Series Instance UID of `1.2.250.1.59.40211.789001276.14556172.67789` found in `ImagingStudy.series.uid`, and
- the DICOM SOP Instance UID of `1.2.250.1.59.40211.2678810.87991027.899772.2` found in `ImagingStudy.series.instance.uid`

we can construct the WADO-URI URL to issue an HTTP GET for a native DICOM PS3.10 instance file (if consistent with the `Accept` header):

```
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 "burn" 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](#).

17.2.4.3 IID

An `Endpoint.connectionType` of code `ihe-iid`, system `http://terminology.hl7.org/CodeSystem/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 a question mark ("?") 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, using the following information in a fictional ImagingStudy resource:

- the WADO-URI service base url of "`https://pacs.hospital.org/IHEInvokeImageDisplay`" found in an `ImagingStudy.endpoint.address`,
- the DICOM Study Instance UID of "`urn:oid:1.2.250.1.59.40211.12345678.678910`" found in an `ImagingStudy.identifier` having `Identifier.system` of "`urn:dicom:uid`",

we can construct the IID URL to invoke a diagnostic quality viewer on the indicated study:

```
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](#), or the introduction on the [IHE IID Profile Wiki](#).

17.2.5 Use Case

17.2.5.1 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](#) 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 \(IID\)](#) profile call using the url elements found in the [ImagingStudy](#).

17.2.5.2 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](#) resource to manage the workflow, with a link to a [ServiceRequest](#) 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. Skann's workstation shows the daily list of [Task](#), and he follows the link to retrieve the [ServiceRequest](#). (He may follow the links through the referenced [Patient](#) resource to access Joe's electronic medical record, but that is not the concern of this storyboard.)

The [Task](#) and [ServiceRequest](#) 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 sonographer's preliminary measurements are stored in the Local MultiClinic Picture Archiving and Communication System (PACS). The PACS creates an [ImagingStudy](#) 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 [ImagingStudy](#) 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](#) document, retrieves the [ImagingStudy](#) 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](#) 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 an imaging study as an [ImagingStudy](#) resource, which includes all the images but excludes the sonographer's preliminary measurements (which as a matter of policy are not shared outside the Local MultiClinic). The imaging study is published to the Metro HIE. (In accordance with [IHE XDS-IR](#), 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 [ImagingStudy](#), and uses it to access the shared images, which she uses to prepare for the cath procedure.

17.2.6 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
    {
        "name": "basedon",
        "type": "reference"
    },
    {
        "name": "bodysite",
        "type": "token"
    },
    {
        "name": "dicom-class",
        "type": "token"
    },
    {
        "name": "encounter",
        "type": "reference"
    },
    {
        "name": "endpoint",
        "type": "reference"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "instance",
        "type": "token"
    },
    {
        "name": "interpreter",
        "type": "reference"
    },
    {
        "name": "modality",
        "type": "token"
    }
]
```

```
        "type": "token"
    },
    {
        "name": "patient",
        "type": "reference"
    },
    {
        "name": "performer",
        "type": "reference"
    },
    {
        "name": "reason",
        "type": "token"
    },
    {
        "name": "referrer",
        "type": "reference"
    },
    {
        "name": "series",
        "type": "token"
    },
    {
        "name": "started",
        "type": "date"
    },
    {
        "name": "status",
        "type": "token"
    },
    {
        "name": "subject",
        "type": "reference"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
basedon	reference	The order for the image	ImagingStudy.basedOn (Appointment , AppointmentResponse , CarePlan , Task , ServiceRequest)	
bodysite	token	The body site studied	ImagingStudy.series.bodySite	
dicom-class	token	The type of the instance	ImagingStudy.series.instance.sopClass	
encounter	reference	The context of the study	ImagingStudy.encounter (Encounter)	

endpoint	reference	The endpoint for the study or series	ImagingStudy.endpoint ImagingStudy.series.endpoint (Endpoint)	
identifier	token	Identifiers for the Study, such as DICOM Study Instance UID and Accession number	ImagingStudy.identifier	30 Resources
instance	token	SOP Instance UID for an instance	ImagingStudy.series.instance.uid	
interpreter	reference	Who interpreted the images	ImagingStudy.interpreter (Practitioner , PractitionerRole)	
modality	token	The modality of the series	ImagingStudy.series.modality	
patient	reference	Who the study is about	ImagingStudy.subject.where(resolve() is Patient) (Patient)	33 Resources
reason	token	The reason for the study	ImagingStudy.reasonCode	
referrer	reference	The referring physician	ImagingStudy.referrer (Practitioner , PractitionerRole)	
series	token	DICOM Series Instance UID for a series	ImagingStudy.series.uid	
started	date	When the study was started	ImagingStudy.started	

status	token	The status of the study	ImagingStudy.status
subject	reference	Who the study is about	ImagingStudy.subject (Group , Device , Patient)

17.2.7 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/imagingstudy-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/imagingstudy-definitions.html
Mappings	http://hl7.org/fhir/R4/imagingstudy-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/imagingstudy-profiles.html

18 Observation

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/observation.html>

Definition: Measurements and simple assertions made about a patient, device or other subject.

18.1 Scope and Usage

This resource is an [event resource](#) from a FHIR workflow perspective - see [Workflow](#).

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](#) resource provides a clinical or workflow context for a set of observations and the

Observation resource is referenced by DiagnosticReport to represent laboratory, imaging, and other clinical and diagnostic data to form a complete report.

Uses for the Observation resource include:

- Vital signs such as [body weight](#), [blood pressure](#), and [temperature](#)
- Laboratory Data like [blood glucose](#), or an [estimated GFR](#)
- Imaging results like [bone density](#) or fetal measurements
- Clinical Findings* such as [abdominal tenderness](#)
- Device measurements such as [EKG data](#) or [Pulse Oximetry data](#)
- Clinical assessment tools such as [APGAR](#) or a [Glasgow Coma Score](#)
- Personal characteristics: such as [eye-color](#)
- Social history like tobacco use, family support, or cognitive status
- Core characteristics like pregnancy status, or a death assertion

*The boundaries between clinical findings and disorders remains a challenge in medical ontology. Refer the [Boundaries](#) section below and in [Condition](#) for general guidance. These boundaries can be clarified by profiling Observation for a particular use case.

18.1.2 Core Profiles for Observation [Trial Use](#)

The following core [profiles](#) 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	The FHIR Vital Signs profile sets 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

18.1.3 Boundaries and Relationships

At its core, Observation allows expressing a name-value pair or structured collection of name-value pairs. As such, it can support conveying any type of information desired. However, that is not its intent. Observation is intended for capturing measurements and subjective point-in-time assessments. It is not intended to be used for those specific contexts and use cases already covered by other FHIR

resources. For example, the [AllergyIntolerance](#) resource represents a patient allergies, [MedicationStatement](#) resource: medications taken by a patient, [FamilyMemberHistory](#) resource: a patient's family history, [Procedure](#) resource: information about a procedure, and [QuestionnaireResponse](#) resource: a set of answers to a set of questions. The Observation resource should not be used to record clinical diagnosis about a patient or subject that are typically captured in the [Condition](#) 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 will however be situations of overlap. For example, a response to a question of "have you ever taken illicit drugs" could in principle be represented using MedicationStatement, but most systems would treat such an assertion as an Observation. In some cases, such as when source data is coming from an [HL7 v2](#) feed, a system might not have information that allows it to distinguish diagnosis, allergy and other "specialized" types of observations from laboratory, 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. Adhering to such convention is an appropriate use of Observation. If implementers are uncertain whether a proposed use of Observation is appropriate, they're encouraged to consult with implementers on [chat.fhir.org implementer's stream](#)

The [Media](#) resource captures a specific type of observation whose value is audio, video or image data. This resource is used instead of Observation to represent such forms of information as it exposes the metadata relevant for interpreting the information. See Media's [boundaries section](#) to see how Media (and Observation) differs from [ImagingStudy](#) and [DocumentReference](#).

In contrast to the Observation 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. "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](#) resource. The Observation resource should not be used to record clinical diagnosis about a patient or subject as discussed above.

18.2 Resource Content

18.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Observation			Domain Resource	Measurements and simple assertions + Rule: <i>dataAbsentReason</i> SHALL only be present if <i>Observation.value[x]</i> is not present + Rule: If <i>Observation.code</i> is the same as an <i>Observation.component.code</i> then the <i>value</i> element associated with the <i>code</i> SHALL NOT be present Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier		0..*	Identifier	Business Identifier for observation
 basedOn		0..*	Reference(CarePlan DeviceRequest ImmunizationRecommendation MedicationRequest NutritionOrder ServiceRequest)	Fulfils plan, proposal or order
 partOf		0..*	Reference(MedicationAdministration MedicationDispense MedicationStatement Procedure)	Part of referenced event

				mmunization ImagingStudy)	
 status	$?!\Sigma$	1..1	code	registered preliminary final amended + ObservationStatus (Required)	
 category		0..*	CodeableConcept	Classification of type of observation Observation Category Codes (Preferred)	
 code	Σ	1..1	CodeableConcept	Type of observation (code / type) LOINC Codes (Example)	
 subject	Σ	0..1	Reference(Patient Group Device Location)	Who and/or what the observation is about	
 focus	Σ	0..*	Reference(Any)	What the observation is about, when it is not about the subject of record	
 encounter	Σ	0..1	Reference(Encounter)	Healthcare event during which this observation is made	
 effective[x]	Σ	0..1		Clinically relevant time/time-period for observation	
 effectiveDat			dateTime		
 effectivePeriod			Period		
 effectiveTiming			Timing		
 effectiveInstant			instant		
 issued	Σ	0..1	instant	Date/Time this version was made available	

 performer	Σ	0..*	Reference(Practitioner PractitionerRole Organization CareTeam Patient RelatedPerson)	Who is responsible for the observation
 value[x]	ΣI	0..1		Actual result
 valueQuantity			Quantity	
 valueCodeableConcept			CodeableConcept	
 valueString			string	
 valueBoolean			boolean	
 valueInteger			integer	
 valueRange			Range	
 valueRatio			Ratio	
 valueSampledData			SampledData	
 valueTime			time	

			dateTime	
	 valueDateTi			
me				
	 valuePeriod		Period	
		I 0..1	CodeableConcept	Why the result is missing DataAbsentReason (Extensible)
	 dataAbsentReason			
	 interpretation	0..*	CodeableConcept	High, low, normal, etc. Observation Interpretation Codes (Extensible)
	 note	0..*	Annotation	Comments about the observation
	 bodySite	0..1	CodeableConcept	Observed body part SNOMED CT Body Structures (Example)
	 method	0..1	CodeableConcept	How it was done Observation Methods (Example)
	 specimen	0..1	Reference(Specimen)	Specimen used for this observation
	 device	0..1	Reference(Device DeviceMetric)	(Measurement) Device
	 referenceRange	I 0..*	BackboneElement	Provides guide for interpretation <i>+ Rule: Must have at least a low or a high or text</i>
	 low	I 0..1	SimpleQuantity	Low Range, if relevant
	 high	I 0..1	SimpleQuantity	High Range, if relevant
	 type	I 0..1	CodeableConcept	Reference range qualifier Observation Reference Range Meaning Codes (Preferred)

 appliesTo	0..*	CodeableConcept	Reference range population
			Observation Reference Range Applies To Codes (Example)
 age	0..1	Range	Applicable age range, if relevant
 text	0..1	string	Text based reference range in an observation
 hasMember	Σ	0..*	Reference(Observation QuestionnaireResponse MolecularSequence)
 derivedFrom	Σ	0..*	Reference(DocumentReference ImagingStudy Media QuestionnaireResponse Observation MolecularSequence)
 component	Σ	0..*	BackboneElement
 code	Σ	1..1	CodeableConcept
			Type of component observation (code / type)
			LOINC Codes (Example)
 value[x]	Σ	0..1	Actual component result
 valueQuantity			Quantity
 valueCodeableConcept			CodeableConcept
 valueString			string

				boolean
				valueBoolean
n				
				integer
				valueInteger
r				
				Range
				valueRange
				Ratio
				valueRatio
				SampledData
				valueSampledData
				time
				valueTime
				dateTime
				valueDateTime
me				
				Period
				valuePeriod
	I	0..1	Codeable Concept	Why the component result is missing DataAbsentReason (Extensible)
	dataAbsentReason			
		0..*	Codeable Concept	High, low, normal, etc. Observation Interpretation Codes (Extensible)
	interpretation			
		0..*	see reference Range	Provides guide for interpretation of component result
	reference			
	Range			

18.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
    "type": "Observation",  
    "profile": {  
        "reference": "http://www.hl7.org/fhir/Observation.html"  
    },  
    "interaction": [  
        {  
            "code": "read",  
            "documentation": "Read the current state of the resource"  
        },  
        {  
            "code": "create",  
            "documentation": "Create a new resource with a server assigned id"  
        },  
        {  
            "code": "update",  
            "documentation": "Update an existing resource by its id"  
        },  
        {  
            "code": "delete",  
            "documentation": "Delete a resource"  
        },  
        {  
            "code": "vread",  
            "documentation": "Read the state of a specific version of the resource"  
        },  
        {  
            "code": "patch"  
        },  
        {  
            "code": "history-instance",  
            "documentation": "Retrieve the change history for a particular resource."  
        },  
        {  
            "code": "history-type",  
            "documentation": "Retrieve the change history for all resources of a  
particular type"  
        },  
        {  
            "code": "search-type",  
            "documentation": "Search the resource type based on some filter criteria"  
        }  
    ],  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4).

Note: not all are supported by RamSoft.

JSON Template

```
{  
  "resourceType" : "Observation",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Business Identifier for observation  
  "basedOn" : [{ Reference(CarePlan|DeviceRequest|ImmunizationRecommendation|MedicationRequest|NutritionOrder|ServiceRequest) }], // Fulfils plan, proposal or order  
  "partOf" : [{ Reference(MedicationAdministration|MedicationDispense|MedicationStatement|Procedure|Immunization|ImagingStudy) }], // Part of referenced event  
  "status" : "<code>", // R! registered | preliminary | final | amended +  
  "category" : [{ CodeableConcept }], // Classification of type of observation  
  "code" : { CodeableConcept }, // R! Type of observation (code / type)  
  "subject" : { Reference(Patient|Group|Device|Location) }, // Who and/or what the observation is about  
  "focus" : [{ Reference(Any) }], // What the observation is about, when it is not about the subject of record  
  "encounter" : { Reference(Encounter) }, // Healthcare event during which this observation is made  
  // effective[x]: Clinically relevant time/time-period for observation. One of these 4:  
  "effectiveDateTime" : "<dateTime>",  
  "effectivePeriod" : { Period },  
  "effectiveTiming" : { Timing },  
  "effectiveInstant" : "<instant>",  
  "issued" : "<instant>", // Date/Time this version was made available  
  "performer" : [{ Reference(Practitioner|PractitionerRole|Organization|CareTeam|Patient|RelatedPerson) }], // Who is responsible for the observation  
  // value[x]: Actual result. One of these 11:  
  "valueQuantity" : { Quantity },  
  "valueCodeableConcept" : { CodeableConcept },  
  "valueString" : "<string>",  
  "valueBoolean" : <boolean>,
```

```
"valueInteger" : <integer>,
"valueRange" : { Range },
"valueRatio" : { Ratio },
"valueSampledData" : { SampledData },
"valueTime" : "<time>",
"valueDateTime" : "<dateTime>",
"valuePeriod" : { Period },
"dataAbsentReason" : { CodeableConcept }, // C? Why the result is missing
"interpretation" : [{ CodeableConcept }], // High, low, normal, etc.
"note" : [{ Annotation }], // Comments about the observation
"bodySite" : { CodeableConcept }, // Observed body part
"method" : { CodeableConcept }, // How it was done
"specimen" : { Reference(Specimen) }, // Specimen used for this observation
"device" : { Reference(Device|DeviceMetric) }, // (Measurement) Device
"referenceRange" : [{ // Provides guide for interpretation
  "low" : { Quantity(SimpleQuantity) }, // C? Low Range, if relevant
  "high" : { Quantity(SimpleQuantity) }, // C? High Range, if relevant
  "type" : { CodeableConcept }, // Reference range qualifier
  "appliesTo" : [{ CodeableConcept }], // Reference range population
  "age" : { Range }, // Applicable age range, if relevant
  "text" : "<string>" // Text based reference range in an observation
}],
"hasMember" : [{ Reference(Observation|QuestionnaireResponse|
MolecularSequence) }], // Related resource that belongs to the Observation group
"derivedFrom" : [{ Reference(DocumentReference|ImagingStudy|Media|
QuestionnaireResponse|Observation|MolecularSequence) }], // Related measurements the observation
is made from
"component" : [{ // Component results
  "code" : { CodeableConcept }, // R! Type of component observation (code / type)
  // value[x]: Actual component result. One of these 11:
  "valueQuantity" : { Quantity },
  "valueCodeableConcept" : { CodeableConcept },
  "valueString" : "<string>",
  "valueBoolean" : <boolean>,
  "valueInteger" : <integer>,
  "valueRange" : { Range },
```

```
"valueRatio" : { Ratio },  
"valueSampledData" : { SampledData },  
"valueTime" : "<utime>",  
"valueDateTime" : "<udateTime>",  
"valuePeriod" : { Period },  
"dataAbsentReason" : { CodeableConcept }, // C? Why the component result is missing  
"interpretation" : [{ CodeableConcept }], // High, low, normal, etc.  
"referenceRange" : [{ Content as for Observation.referenceRange }]] // Provides guide for interpretation of component result  
}  
]  
}
```

18.2.3 Terminology Bindings

Path	Definition	Type	Reference
Observation.status	Codes providing the status of an observation.	Required	ObservationStatus
Observation.category	Codes for high level observation categories.	Preferred	ObservationCategoryCodes
Observation.code Observation.component.code	Codes identifying names of simple observations.	Example	LOINCCodes
Observation.dataAbsentReason Observation.component.dataAbsentReason	Codes specifying why the result ('Observation.value[x]') is missing.	Extensible	DataAbsentReason
Observation.interpretation Observation.component.interpretation	Codes identifying interpretations of observations.	Extensible	ObservationInterpretationCodes
Observation.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMEDCTBodyStructures

Observation.method	Methods for simple observations.	Example	ObservationMethods
Observation.referenceRange.type	Code for the meaning of a reference range.	Preferred	ObservationReferenceRangeMeaningCodes
Observation.referenceRange.appliesTo	Codes identifying the population the reference range applies to.	Example	ObservationReferenceRangeAppliesToCodes

18.2.4 Constraints

Id	Level	Location	Description	Expression
obs-3	Rule	Observation.referenceRange	Must have at least a low or a high or text	low.exists() or high.exists() or text.exists()
obs-6	Rule	(base)	dataAbsentReason SHALL only be present if Observation.value[x] is not present	dataAbsentReason.empty() or value.empty()
obs-7	Rule	(base)	If Observation.code is the same as an Observation.component.code then the value element associated with the code SHALL NOT be present	value.empty() or component.code.where(coding.intersect(%resource.code.coding).exists()).empty()

18.2.5 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "referenceRangeType"
  }
]
```

```
        "name": "based-on",
        "type": "reference"
    },
    {
        "name": "category",
        "type": "token"
    },
    {
        "name": "code",
        "type": "token"
    },
    {
        "name": "code-value-concept",
        "type": "composite"
    },
    {
        "name": "code-value-date",
        "type": "composite"
    },
    {
        "name": "code-value-quantity",
        "type": "composite"
    },
    {
        "name": "code-value-string",
        "type": "composite"
    },
    {
        "name": "combo-code",
        "type": "token"
    },
    {
        "name": "combo-code-value-concept",
        "type": "composite"
    },
    {
        "name": "combo-code-value-quantity",
        "type": "composite"
    },
    {
        "name": "combo-data-absent-reason",
        "type": "token"
    },
    {
        "name": "combo-value-concept",
        "type": "token"
    },
    {
        "name": "combo-value-quantity",
        "type": "quantity"
    },
    {
        "name": "component-code",
        "type": "token"
    },
    {
        "name": "component-code-value-concept",
        "type": "composite"
    },
    {
        "name": "component-code-value-quantity",
        "type": "composite"
    },
    {
        "name": "component-data-absent-reason",
        "type": "token"
    },
```

```
{  
  "name": "component-value-concept",  
  "type": "token"  
},  
{  
  "name": "component-value-quantity",  
  "type": "quantity"  
},  
{  
  "name": "data-absent-reason",  
  "type": "token"  
},  
{  
  "name": "date",  
  "type": "date"  
},  
{  
  "name": "derived-from",  
  "type": "reference"  
},  
{  
  "name": "device",  
  "type": "reference"  
},  
{  
  "name": "encounter",  
  "type": "reference"  
},  
{  
  "name": "focus",  
  "type": "reference"  
},  
{  
  "name": "has-member",  
  "type": "reference"  
},  
{  
  "name": "identifier",  
  "type": "token"  
},  
{  
  "name": "method",  
  "type": "token"  
},  
{  
  "name": "part-of",  
  "type": "reference"  
},  
{  
  "name": "patient",  
  "type": "reference"  
},  
{  
  "name": "performer",  
  "type": "reference"  
},  
{  
  "name": "specimen",  
  "type": "reference"  
},  
{  
  "name": "status",  
  "type": "token"  
},  
{  
  "name": "subject",  
  "type": "reference"  
}
```

```
},
{
  "name": "value-concept",
  "type": "token"
},
{
  "name": "value-date",
  "type": "date"
},
{
  "name": "value-quantity",
  "type": "quantity"
},
{
  "name": "value-string",
  "type": "string"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In	Common
based- on TU	reference	Reference to the service request.	Observation.basedOn (CarePlan , MedicationRequest , NutritionOrder , DeviceRequest , ServiceRequest , Immunization Recommendation)		
category TU	token	The classification of the type of observation	Observation.category		
code I U	token	The code of the observation type	Observation.code		13 Resources
code- value- concep t TU	composite	Code and coded value parameter pair	On Observation: code: code value-concept: value.as(CodeableConcept)		

code-	composite	Code and	On Observation:
value-		date/time	code: code
date I		value	value-date: value.as(DateTime) value.as(Period)
U		parameter	
		pair	

code-	composite	Code and	On Observation:
value-		quantity value	code: code
quantit		parameter	value-quantity: value.as(Quantity)
y TU		pair	

code-	composite	Code and	On Observation:
value-		string value	code: code
string		parameter	value-string: value.as(string)
TU		pair	

combo	token	The code of	Observation.code Observation.component.code
-		the	
code I		observation	
U		type or	
		component	
		type	

combo	composite	Code and	On Observation Observation.component:
-code-		coded value	combo-code: code
value-		parameter	combo-value-concept: value.as(CodeableConcept)
concep		pair, including	
TU		in components	

combo	composite	Code and	On Observation Observation.component:
-code-		quantity value	combo-code: code
value-		parameter	combo-value-quantity: value.as(Quantity)
quantit		pair, including	
y TU		in components	

combo	token	The reason	Observation.dataAbsentReason
-data-		why the	Observation.component.dataAbsentReason

absent	expected	
-	value in the	
reason	element	
<u>TU</u>	Observation.v	
	alue[x] or	
	Observation.c	
	omponent.val	
	ue[x] is	
	missing.	
combo <u>token</u>	The value or	(Observation.value as CodeableConcept)
-value-	component	(Observation.component.value as CodeableConcept)
concep	value of the	
t <u>TU</u>	observation, if	
	the value is a	
	CodeableConc	
	ept	
combo <u>quantity</u>	The value or	(Observation.value as Quantity) (Observation.value
-value-	component	as SampledData) (Observation.component.value as
quantit	value of the	Quantity) (Observation.component.value as
y <u>TU</u>	observation, if	SampledData)
	the value is a	
	Quantity, or a	
	SampledData	
	(just search	
	on the bounds	
	of the values	
	in sampled	
	data)	
compo <u>token</u>	The	Observation.component.code
nent-	component	
code <u>I</u>	code of the	
<u>U</u>	observation	
	type	

compo	composite	Component	On Observation.component: code and component-code: code
-		code-	component-value-concept:
-		value-	coded value value.as(CodeableConcept)
-		concep	parameter
t	TU		pair
compo	composite	Component	On Observation.component: code and component-code: code
-		code-	component-value-quantity: value.as(Quantity)
-		value-	quantity value
-		quantit	parameter
y	TU		pair
compo	token	The reason why the expected value in the element Observation.c TU	Observation.component.dataAbsentReason omponent.val ue[x] is missing.
compo	token	The value of the component observation, if the value is a CodeableConc ept	(Observation.component.value as CodeableConcept)
compo	quantity	The value of the component observation, if the value is a	(Observation.component.value as Quantity) (Observation.component.value as SampledData)

quantitative TU	Quantity, or a SampledData (just search on the bounds of the values in sampled data)	
data-absent TU	The reason why the expected value in the element Observation.value[x] is missing.	Observation.dataAbsentReason
date TU	Obtained date/time. If the obtained element is a period, a date that falls in the period	Observation.effective
derived TU	Related measurement s the observation is made from	Observation.derivedFrom (Media , Observation , ImagingStudy , MolecularSequence , QuestionnaireResponse , DocumentReference)
device TU	The Device that generated the observation data.	Observation.device (Device , DeviceMetric)

encounter reference	Encounter	Observation.encounter	12
ter TU	related to the	(Encounter)	Resources
	observation		
focus TU reference	The focus of an observation when the focus is not the patient of record.	Observation.focus	
has-member TU reference	Related resource that belongs to the Observation	Observation.hasMember	
	Observation group	(Observation , MolecularSequence , QuestionnaireResponse)	
identifier TU token	The unique id for a particular observation	Observation.identifier	30
			Resources
method TU token	The method used for the observation	Observation.method	
part-of TU reference	Part of referenced event	Observation.partOf	
	(Immunization , MedicationDispense , MedicationAdministration , Procedure , ImagingStudy , MedicationStatement)		
patient TU reference	The subject that the observation is about (if patient)	Observation.subject.where(resolve() is Patient)	33
		(Patient)	Resources

perfor	reference	Who	Observation.performer
mer I		performed the	(Practitioner , Organization , CareTeam , Patient , PractitionerRole , RelatedPerson)
U		observation	
specim	reference	Specimen	Observation.specimen
en TU		used for this	(Specimen)
		observation	
status	token	The status of	Observation.status
TU		the	
		observation	
subject	reference	The subject	Observation.subject
TU		that the	(Group , Device , Patient , Location)
		observation is	
		about	
value-	token	The value of	(Observation.value as CodeableConcept)
concep		the	
t TU		observation, if	
		the value is a	
		CodeableConc	
		ept	
value-	date	The value of	(Observation.value as dateTime)
date I		the	(Observation.value as Period)
U		observation, if	
		the value is a	
		date or period	
		of time	
value-	quantity	The value of	(Observation.value as Quantity) (Observation.value as SampledData)
quantit		the	
y TU		observation, if	
		the value is a	
		Quantity, or a	
		SampledData	

(just search
on the bounds
of the values
in sampled
data)

value- string	<p><u>string</u> The value of (Observation.value as string) (Observation.value as CodeableConcept).text</p> <p><u>TU</u> observation, if the value is a string, and also searches in CodeableConcept.text</p>
------------------	--

18.2.6 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/observation-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/observation-definitions.html
Mappings	http://hl7.org/fhir/R4/observation-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/observation-profiles.html
Operations	http://hl7.org/fhir/R4/observation-operations.html
*Notes (10.1.4)	http://hl7.org/fhir/R4/observation.html

19 Organization

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/organization.html>

Definition: A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, payer/insurer, etc.

19.1 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](#), [message](#) or as a [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.

19.1.1 Boundaries and Relationships

The Organization resource is used for collections of people that have come together to achieve an objective. The [Group](#) 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 might not be the location where the service took place.

19.2 Resource Content

19.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Organization	 ITU		DomainResource	A grouping of people or organizations with a common purpose <i>+ Rule: The organization SHALL at least have a name or an identifier, and possibly more than one</i> Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	 ΣI	0..*	Identifier	Identifies this organization across multiple systems
 active	 ?IΣ	0..1	boolean	Whether the organization's record is still in active use
 type	 Σ	0..*	CodeableConcept	Kind of organization Organization type (Example)
 name	 ΣI	0..1	string	Name used for the organization
 alias		0..*	string	A list of alternate names that the organization is known as, or was known as in the past
 telecom	 I	0..*	ContactPoint	A contact detail for the organization <i>+ Rule: The telecom of an organization can never be of use 'home'</i>
 address	 I	0..*	Address	An address for the organization <i>+ Rule: An address of an organization can never be of use 'home'</i>

 partOf	Σ	0..1	Reference(Organization)	The organization of which this organization forms a part
 contact		0..*	BackboneElement	Contact for the organization for a certain purpose
 purpose		0..1	CodeableConcept	The type of contact Contact entity type (Extensible)
 name		0..1	HumanName	A name associated with the contact
 telecom		0..*	ContactPoint	Contact details (telephone, email, etc.) for a contact
 address		0..1	Address	Visiting or postal addresses for the contact
 endpoint		0..*	Reference(Endpoint)	Technical endpoints providing access to services operated for the organization

19.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Organization",
  "profile": {
    "reference": "http://www.hl7.org/fhir/Organization.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "vread"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance"
    },
    {
      "code": "history-type"
    },
    {
      "code": "search-type"
    }
  ]
}
```

],

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4).

Note: not all are supported by RamSoft.

JSON Template

```
{  
  ?  
  "resourceType" : "Organization",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // C? Identifies this organization across multiple systems  
  "active" : <boolean>, // Whether the organization's record is still in active use  
  "type" : [{ CodeableConcept }], // Kind of organization  
  "name" : "<string>", // C? Name used for the organization  
  "alias" : ["<string>"], // A list of alternate names that the organization is known as, or was known as in the past  
  "telecom" : [{ ContactPoint }], // C? A contact detail for the organization  
  "address" : [{ Address }], // C? An address for the organization  
  "partOf" : { Reference(Organization) }, // The organization of which this organization forms a part  
  "contact" : [{ // Contact for the organization for a certain purpose  
    "purpose" : { CodeableConcept }, // The type of contact  
    "name" : { HumanName }, // A name associated with the contact  
    "telecom" : [{ ContactPoint }], // Contact details (telephone, email, etc.) for a contact  
    "address" : { Address } // Visiting or postal addresses for the contact  
  }],  
  "endpoint" : [{ Reference(Endpoint) }] // Technical endpoints providing access to services operated for the organization  
}
```

19.2.3 Terminology Bindings

Path	Definition	Type	Reference
Organization.type	Used to categorize the organization.	Example	OrganizationType
Organization.contact.purpose	The purpose for which you would contact a contact party.	Extensible	ContactEntityType

19.2.4 Constraints

id	Level	Location	Description	Expression
org-1	Rule	(base)	The organization SHALL at least have a name or an identifier, and possibly more than one	<code>(identifier.count() + name.count()) > 0</code>
org-2	Rule	Organization.address	An address of an organization can never be of use 'home'	<code>where (use = 'home').empty()</code>
org-3	Rule	Organization.telecom	The telecom of an organization can never be of use 'home'	<code>where (use = 'home').empty()</code>

19.2.5 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

 Nuclear Medicine Research Trials (edu)

 Maternity Ward

 Childrens Ward

 Day Procedures Unit

 Mobile Services (Ambulance)

 Research Center (edu)

```
Nuclear Medicine (edu)
Burgers University (edu)
Nuclear Medicine Faculty (edu)
Undergraduate Medicine (edu)
...
...
```

Note that physical structures of this hierarchy are not present - these are defined by a Location hierarchy.

19.2.6 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "active",
    "type": "token"
  },
  {
    "name": "address",
    "type": "string"
  },
  {
    "name": "address-city",
    "type": "string"
  },
  {
    "name": "address-country",
    "type": "string"
  },
  {
    "name": "address-postalcode",
    "type": "string"
  },
  {
    "name": "address-state",
    "type": "string"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "name",
    "type": "string"
  },
  {
    "name": "partof",
    "type": "token"
  },
  {
    "name": "type",
    "type": "token"
  },
  {
    "name": "address-use",
    "type": "token"
  }
]
```

```
  },
  {
    "name": "endpoint",
    "type": "reference"
  },
  {
    "name": "phonetic",
    "type": "string"
  }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	Is the Organization record active	Organization.active	
address	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text	Organization.address	
address-city	string	A city specified in an address	Organization.address.city	
address-country	string	A country specified in an address	Organization.address.country	
address-postalcode	string	A postal code specified in an address	Organization.address.postalCode	
address-state	string	A state specified in an address	Organization.address.state	
address-use	token	A use code specified in an address	Organization.address.use	
endpoint	reference	Technical endpoints providing access to services operated for the organization	Organization.endpoint (Endpoint)	

identifier	token	Any identifier for the organization (not the accreditation issuer's identifier)	Organization.identifier
name	string	A portion of the organization's name or alias	Organization.name Organization.alias
partof	reference	An organization of which this organization forms a part	Organization.partOf (Organization)
phonetic	string	A portion of the organization's name using some kind of phonetic matching algorithm	Organization.name
type	token	A code for the type of organization	Organization.type

19.2.7 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/organization-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/organization-definitions.html
Mappings	http://hl7.org/fhir/R4/organization-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/organization-profiles.html

20 Organization Affiliation

Note: the following sections reference the FHIR standards version R4 –
<http://hl7.org/fhir/R4/organizationaffiliation.html>

Definition: Defines an affiliation/assotiation/relationship between 2 distinct organizations, that is not a part-of relationship/sub-division relationship.

20.1 Scope and Usage

A relationship between 2 organizations over a period of time, where the entities are separate business entities. The relationship can optionally include details of locations/services from the participating organization.

The OrganizationAffiliation enables defining non-hierarchical relationships between organizations. For example:

- One organization may provide services to another organization
e.g. An agency service providing casual staff, a radiology service, a diagnostic lab, catering services, community care services etc.
- Two or more organizations may form a partnership or joint venture
- An organization may be a member of an association, but not owned by it
e.g. a hospital is a member the American Hospital Association, a hospital is a member of a health information exchange network

20.1.1 Boundaries and Relationships

The Organization.partOf is used to form a hierarchical relationships within an organization which eventually resolves to a single organization. Each child in the tree is a subdivision of the parent.

The OrganizationAffiliation is used to describe the relationship between two distinct organizations. It does not require a hierarchical relationship. A resource instance is for a singular linkage between 2 organizations (it does not contain all members), to create multiple affiliations, create additional resources for the other relationship between other organizations.

Each instance contains its own period, and optionally links to specific related services/locations that are available. These referenced locations/services should be associated with the participating organization, and are available to the primary organization.

This resource should not be used when the affiliates are part of a single organization.

20.2 Resource Content

20.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Organization Affiliation	TU		DomainResource	Defines an affiliation/assotiation/relationship between 2 distinct organizations, that is not a part-of relationship/sub-division relationship Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	Business identifiers that are specific to this role
 active	Σ	0..1	boolean	Whether this organization affiliation record is in active use
 period	Σ	0..1	Period	The period during which the participatingOrganization is affiliated with the primary organization
 organization	Σ	0..1	Reference(Organization)	Organization where the role is available
 participating Organization	Σ	0..1	Reference(Organization)	Organization that provides/performs the role (e.g. providing services or is a member of)
 network	Σ	0..*	Reference(Organization)	Health insurance provider network in which the participatingOrganization provides the

				role's services (if defined) at the indicated locations (if defined)
 code	Σ	0..*	CodeableConcept	Definition of the role the participatingOrganization plays Organization Affiliation Role (Example)
 specialty	Σ	0..*	CodeableConcept	Specific specialty of the participatingOrganization in the context of the role Practice Setting Code Value Set (Preferred)
 location	Σ	0..*	Reference(Location)	The location(s) at which the role occurs
 healthcareService		0..*	Reference(HealthcareService)	Healthcare services provided through the role
 telecom	Σ	0..*	ContactPoint	Contact details at the participatingOrganization relevant to this Affiliation
 endpoint		0..*	Reference(Endpoint)	Technical endpoints providing access to services operated for this role

20.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "OrganizationAffiliation",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/organizationaffiliation.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    }
  ]
}
```

```
        "documentation": "Delete a resource"
    },
    {
        "code": "vread",
        "documentation": "Read the state of a specific version of the resource"
    },
    {
        "code": "patch"
    },
    {
        "code": "history-instance",
        "documentation": "Retrieve the change history for a particular resource."
    },
    {
        "code": "history-type",
        "documentation": "Retrieve the change history for all resources of a
particular type"
    },
    {
        "code": "search-type",
        "documentation": "Search the resource type based on some filter criteria"
    }
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?
  "resourceType" : "OrganizationAffiliation",
  // from Resource: id, meta, implicitRules, and language
  // from DomainResource: text, contained, extension, and modifierExtension
  "identifier" : [{ Identifier }], // Business identifiers that are specific to this role
  "active" : <boolean>, // Whether this organization affiliation record is in active use
  "period" : { Period }, // The period during which the participatingOrganization is affiliated with the primary organization
  "organization" : { Reference(Organization) }, // Organization where the role is available
  "participatingOrganization" : { Reference(Organization) }, // Organization that provides/performs the role (e.g. providing services or is a member of)
  "network" : [{ Reference(Organization) }], // Health insurance provider network in which the participatingOrganization provides the role's services (if defined) at the indicated locations (if defined)
  "code" : [{ CodeableConcept }], // Definition of the role the participatingOrganization plays
  "specialty" : [{ CodeableConcept }], // Specific specialty of the participatingOrganization in the context of the role
  "location" : [{ Reference(Location) }], // The location(s) at which the role occurs
  "healthcareService" : [{ Reference(HealthcareService) }], // Healthcare services provided through the role
```

```
"telecom" : [{ ContactPoint }], // Contact details at the participatingOrganization relevant to this Affiliation
"endpoint" : [{ Reference\(Endpoint\) }] // Technical endpoints providing access to services operated for this role
}
```

20.2.3 Terminology Bindings

Path	Definition	Type	Reference
OrganizationAffiliation.code	The role the participating organization providing services to the primary organization.	Example	OrganizationAffiliationRole
OrganizationAffiliation.specialty	Specific specialty associated with the participating organization.	Preferred	PracticeSettingCodeValueSet

20.2.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "active",
    "type": "token"
  },
  {
    "name": "date",
    "type": "date"
  },
  {
    "name": "email",
    "type": "token"
  },
  {
    "name": "endpoint",
    "type": "reference"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "location",
    "type": "reference"
  },
  {
    "name": "network",
    "type": "reference"
  },
  {
    "name": "organization",
    "type": "reference"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "practitioner",
    "type": "reference"
  },
  {
    "name": "practitionerRole",
    "type": "reference"
  },
  {
    "name": "role",
    "type": "reference"
  },
  {
    "name": "substance",
    "type": "reference"
  }
],
```

```
{
  "name": "participating-organization",
  "type": "reference"
},
{
  "name": "phone",
  "type": "token"
},
{
  "name": "primary-organization",
  "type": "reference"
},
{
  "name": "role",
  "type": "token"
},
{
  "name": "service",
  "type": "reference"
},
{
  "name": "specialty",
  "type": "token"
},
{
  "name": "telecom",
  "type": "token"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	Whether this organization affiliation record is in active use	OrganizationAffiliation.active	
date	date	The period during which the participatingOrganization is affiliated with the primary organization	OrganizationAffiliation.period	
email	token	A value in an email contact	OrganizationAffiliation.telecom.where (system='email')	
endpoint	reference	Technical endpoints providing access to services operated for this role	OrganizationAffiliation.endpoint (Endpoint)	

identifier	token	An organization affiliation's Identifier	OrganizationAffiliation.identifier
location	reference	The location(s) at which the role occurs	OrganizationAffiliation.location (Location)
network	reference	Health insurance provider network in which the participatingOrganization provides the role's services (if defined) at the indicated locations (if defined)	OrganizationAffiliation.network (Organization)
participating- organization	reference	The organization that provides services to the primary organization	OrganizationAffiliation.participatingOrganization (Organization)
phone	token	A value in a phone contact	OrganizationAffiliation.telecom.where(system='phone')
primary- organization	reference	The organization that receives the services from the participating organization	OrganizationAffiliation.organization (Organization)
role	token	Definition of the role the participatingOrganization plays	OrganizationAffiliation.code
service	reference	Healthcare services provided through the role	OrganizationAffiliation.healthcareService (HealthcareService)
specialty	token	Specific specialty of the participatingOrganization in the context of the role	OrganizationAffiliation.specialty
telecom	token	The value in any kind of contact	OrganizationAffiliation.telecom

20.2.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/organizationaffiliation-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/organizationaffiliation-definitions.html
Mappings	http://hl7.org/fhir/R4/organizationaffiliation-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/organizationaffiliation-profiles.html

21 Patient

Note: the following sections reference the FHIR standards version R4 -
<http://hl7.org/fhir/R4/patient.html>

Definition: Demographics and other administrative information about an individual or animal receiving care or other health-related services.

21.1 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, nationality, etc.), but may be found in [profiles](#) defined for specific jurisdictions (e.g., US Meaningful Use Program) or [standard extensions](#). Such fields vary widely between jurisdictions and often have different names and value sets for the similar concepts, but they are not similar enough to be able to map and exchange.

21.2 Resource Content

21.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints
 Patient	 N		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	 Σ	0..*	Identifier	An identifier for this patient
 active	 ?!Σ	0..1	boolean	Whether this patient's record is in active use
 name	 Σ	0..*	HumanName	A name associated with the patient
 telecom	 Σ	0..*	ContactPoint	A contact detail for the individual
 gender	 Σ	0..1	code	male female other unknown AdministrativeGender (Required)
 birthDate	 Σ	0..1	date	The date of birth for the individual

 deceased[x]	? Σ	0..1		Indicates if the individual is deceased or not
 deceasedBoo lean			boolean	
 deceasedDat eTime			dateTime	
 address	Σ	0..*	Address	An address for the individual
 maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient MaritalStatus (Extensible)
 multipleBirth [x]		0..1		Whether patient is part of a multiple birth
 multipleBirth Boolean			boolean	
 multipleBirth Integer			integer	
 photo		0..*	Attachment	Image of the patient
 contact	I	0..*	BackboneElement	A contact party (e.g. guardian, partner, friend) for the patient + Rule: <i>SHALL at least contain a contact's details or a reference to an organization</i>
 relationship		0..*	CodeableConcept	The kind of relationship Patient Contact Relationship (Extensible)
 name		0..1	HumanName	A name associated with the contact person

 telecom	0..*	ContactPoint	A contact detail for the person	
 address	0..1	Address	Address for the contact person	
 gender	0..1	code	male female other unknown AdministrativeGender (Required)	
 organization	I 0..1	Reference(Organization)	Organization that is associated with the contact	
 period	0..1	Period	The period during which this contact person or organization is valid to be contacted relating to this patient	
 communicati on	0..*	BackboneElement	A language which may be used to communicate with the patient about his or her health	
 language	1..1	CodeableConcept	The language which can be used to communicate with the patient about his or her health Common Languages (Preferred but limited to AllLanguages)	
 preferred	0..1	boolean	Language preference indicator	
 generalPracti tioner	0..*	Reference(Organization Practitioner PractitionerRole)	Patient's nominated primary care provider	
 managingOr ganization	Σ	0..1	Reference(Organization)	Organization that is the custodian of the patient record
 link	? Σ	0..*	BackboneElement	Link to another patient resource that concerns the same actual person

 other	Σ	1..1	Reference(Patient RelatedPerson)	The other patient or related person resource that the link refers to
 type	Σ	1..1	code	replaced-by replaces refer see also LinkType (Required)

21.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Patient",
  "profile": {
    "reference": "http://www.hl7.org/fhir/patient.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    },
    {
      "code": "vread",
      "documentation": "Read the state of a specific version of the resource"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance",
      "documentation": "Retrieve the change history for a particular resource."
    },
    {
      "code": "history-type",
      "documentation": "Retrieve the change history for all resources of a
particular type"
    },
    {
      "code": "search-type",
      "documentation": "Search the resource type based on some filter criteria"
    }
  ]
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4).

Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Patient",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // An identifier for this patient  
  "active" : <boolean>, // Whether this patient's record is in active use  
  "name" : [{ HumanName }], // A name associated with the patient  
  "telecom" : [{ ContactPoint }], // A contact detail for the individual  
  "gender" : "<code>", // male | female | other | unknown  
  "birthDate" : "<date>", // The date of birth for the individual  
  // deceased[x]: Indicates if the individual is deceased or not. One of these 2:  
  "deceasedBoolean" : <boolean>,  
  "deceasedDateTime" : "<dateTime>",  
  "address" : [{ Address }], // An address for the individual  
  "maritalStatus" : { CodeableConcept }, // Marital (civil) status of a patient  
  // multipleBirth[x]: Whether patient is part of a multiple birth. One of these 2:  
  "multipleBirthBoolean" : <boolean>,  
  "multipleBirthInteger" : <integer>,  
  "photo" : [{ Attachment }], // Image of the patient  
  "contact" : [{ // A contact party (e.g. guardian, partner, friend) for the patient  
    "relationship" : [{ CodeableConcept }], // The kind of relationship  
    "name" : { HumanName }, // A name associated with the contact person  
    "telecom" : [{ ContactPoint }], // A contact detail for the person  
    "address" : { Address }, // Address for the contact person  
    "gender" : "<code>", // male | female | other | unknown  
    "organization" : { Reference(Organization) }, // C? Organization that is associated with the contact  
    "period" : { Period } // The period during which this contact person or organization is valid to be contacted relating to this patient  
  }],
```

```
"communication" : [{ // A language which may be used to communicate with the patient about his or her health
  "language" : { CodeableConcept }, // R! The language which can be used to communicate with the patient about his or her health
  "preferred" : <boolean> // Language preference indicator
},
"generalPractitioner" : [{ Reference(Organization|Practitioner|PractitionerRole) }], // Patient's nominated primary care provider
"managingOrganization" : { Reference(Organization) }, // Organization that is the custodian of the patient record
"link" : [{ // Link to another patient resource that concerns the same actual person
  "other" : { Reference(Patient|RelatedPerson) }, // R! The other patient or related person resource that the link refers to
  "type" : "<code>" // R! replaced-by | replaces | refer |seealso
}
}]
```

21.2.3 Terminology Bindings

Path	Definition	Type	Reference
Patient.gender	The gender of a person used for administrative purposes.	Required	AdministrativeGender
Patient.contact.gender			
Patient.maritalStatus	The domestic partnership status of a person.	Extensible	Marital Status Codes
Patient.contact.relationship	The nature of the relationship between a patient and a contact person for that patient.	Extensible	PatientContactRelationship

Patient.communication.language	A human language.	Preferred , but limited to AllLanguages	CommonLanguages
Patient.link.type	The type of link between this patient resource and another patient resource.	Required	LinkType

21.2.4 Constraints

id	Level	Location	Description	Expression
pat-1	Rule	Patient.contact	SHALL at least contain a contact's details or a reference to an organization	name.exists() or telecom.exists() or address.exists() or organization.exists()

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.

21.2.5 Patient ids and Patient resource ids

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.

Where there is a need to implement an automated MRN Identifier created for a patient record, this could be achieved by providing an identifier in the patient with an appropriate assigner, MRN Type and/or system but with *no value* assigned. Internal business rules can then detect this and replace/populate this identifier with 1 or more identifiers (as required).

21.2.6 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:

21.2.7 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.

21.2.8 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 are known to hold a more comprehensive and/or authoritative record of the same patient. The link type 'refer' is used to denote such a link. Note that linked records may contain contradictory information. The record referred to does not point back to the referring record.

21.2.9 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 authoritative 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.

21.2.10 Patient vs. Person vs. Patient.Link vs. Linkage

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.

The [Linkage](#) resource and the Patient.link property conceptually perform similar functions in FHIR, both provide an assertion of linkages between multiple resource instances that are referring to the same underlying individual.

When a Patient resource is linked/merged then it needs to have an internal indication that there is another patient resource that should be considered when referencing other records, which is achieved using the patient.link property.

Not detecting/checking for a potential linkage could mean that related clinical records are not discovered, potentially impacting patient safety. (which is why using the Linkage resource is not appropriate, as its use in this manner would force the use of either another query to potentially locate other patient resources to consider, or use _revinclude)

21.2.11 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.

21.2.12 Patient Matching using an MPI

A Master Patient Index ([MPI](#)) 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](#) 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 process them 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 no patient matches, the MPI SHALL return an empty search set with no error, but may include an [operation outcome](#) with further advice. All patient records should have a score from 0 to 1, where 1 is the most certain match, along with an [extension "match-grade"](#) 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 match-grade extension has one of the [following codes](#):

certain	This record meets the matching criteria to be automatically considered as a full match.
probable	This record is a close match, but not a certain match. Additional review (e.g. by a human) may be required before using this as a match.
possible	This record may be a matching one. Additional review (e.g. by a human) SHOULD be performed before using this as a match.
certainly-not	This record is known not to be a match. Note that usually non-matching records are not returned, but in some cases records previously or likely considered as a match may specifically be negated by the matching engine.

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 insufficient 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.

21.2.13 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "active",  
        "type": "token"  
    },  
    {  
        "name": "address",  
        "type": "string"  
    },  
    {  
        "name": "address-city",  
        "type": "string"  
    },  
    {  
        "name": "address-country",  
        "type": "string"  
    },  
    {  
        "name": "address-postalcode",  
        "type": "string"  
    },  
    {  
        "name": "address-state",  
        "type": "string"  
    },  
    {  
        "name": "address-use",  
        "type": "token"  
    },  
    {  
        "name": "birthdate",  
        "type": "date"  
    },  
    {  
        "name": "death-date",  
        "type": "date"  
    },  
    {  
        "name": "deceased",  
        "type": "token"  
    },  
    {  
        "name": "email",  
        "type": "token"  
    },  
    {  
        "name": "family",  
        "type": "string"  
    },  
    {  
        "name": "gender",  
        "type": "token"  
    },  
    {  
        "name": "general-practitioner",  
        "type": "reference"  
    },  
    {  
        "name": "given",  
        "type": "string"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    }]
```

```
        },
        {
            "name": "language",
            "type": "token"
        },
        {
            "name": "link",
            "type": "reference"
        },
        {
            "name": "name",
            "type": "string"
        },
        {
            "name": "organization",
            "type": "reference"
        },
        {
            "name": "phone",
            "type": "token"
        },
        {
            "name": "phonetic",
            "type": "string"
        },
        {
            "name": "telecom",
            "type": "token"
        }
    ]
}
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active TU	token	Whether the patient record is active	Patient.active	
address TU	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text	Patient.address	3 Resources
address-city TU	string	A city specified in an address	Patient.address.city	3 Resources
address- country TU	string	A country specified in an address	Patient.address.country	3 Resources
address- postalcode TU	string	A postalCode specified in an address	Patient.address.postalCo de	3 Resources

address-state TU	string	A state specified in an address	Patient.address.state	3 Resources
address-use TU	token	A use code specified in an address	Patient.address.use	3 Resources
birthdate TU	date	The patient's date of birth	Patient.birthDate	2 Resources
death-date TU	date	The date of death has been provided and satisfies this search value	(Patient.deceased as dateTime)	
deceased TU	token	This patient has been marked as deceased, or as a death date entered	Patient.deceased.exists() and Patient.deceased != false	
email TU	token	A value in an email contact	Patient.telecom.where(system='email')	4 Resources
family TU	string	A portion of the family name of the patient	Patient.name.family	1 Resources
gender TU	token	Gender of the patient	Patient.gender	3 Resources
general-practitioner TU	reference	Patient's nominated general practitioner, not the organization that manages the record	Patient.generalPractitioner (Practitioner , Organization , PractitionerRole)	
given TU	string	A portion of the given name of the patient	Patient.name.given	1 Resources
identifier TU	token	A patient identifier	Patient.identifier	
language TU	token	Language code (irrespective of use value)	Patient.communication.language	
link TU	reference	All patients linked to the given patient	Patient.link.other (Patient , RelatedPerson)	

name	TU	string	A server defined search that may match any of the string fields in the HumanName, including family, give, prefix, suffix, and/or text	Patient.name	
organization	TU	reference	The organization that is the custodian of the patient record	Patient.managingOrganization	(Organization)
phone	TU	token	A value in a phone contact	Patient.telecom.where(system='phone')	4 Resources
phonetic	TU	string	A portion of either family or given name using some kind of phonetic matching algorithm	Patient.name	3 Resources
telecom	TU	token	The value in any kind of telecom details of the patient	Patient.telecom	4 Resources

21.2.14 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/patient-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/patient-definitions.html
Mappings	http://hl7.org/fhir/R4/patient-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/patient-profiles.html
Operations	http://hl7.org/fhir/R4/patient-operations.html

22 Practitioner

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/practitioner.html>

Definition: A person who is directly or indirectly involved in the provisioning of healthcare.

22.1 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, dentists, pharmacists
- physician assistants, nurses, scribes
- midwives, dietitians, therapists, optometrists, paramedics
- medical technicians, laboratory scientists, prosthetic technicians, radiographers
- social workers, professional homecare providers, 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)

22.1.1 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](#) 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](#) can be used to indicate the species of a service animal.

The [PractitionerRole](#) resource provides the details of roles that the practitioner is approved to perform for which organizations (and at which locations, and optionally what services too).

Practitioners are also often grouped into [CareTeams](#) independently of roles, where the CareTeam defines what specific role that they are fulfilling within the team, and might or might not have actual practitioner role resources created for the practitioner (and in the care team context, the organization the practitioner is representing).

22.2 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.

22.3 Resource Content

22.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Practitioner	TU		DomainResource	A person with a formal responsibility in the provisioning of healthcare or related services Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	An identifier for the person as this agent
 active	Σ	0..1	boolean	Whether this practitioner's record is in active use
 name	Σ	0..*	HumanName	The name(s) associated with the practitioner
 telecom	Σ	0..*	ContactPoint	A contact detail for the practitioner (that apply to all roles)

 address	Σ	0..*	Address	Address(es) of the practitioner that are not role specific (typically home address)
 gender	Σ	0..1	code	male female other unknown AdministrativeGender (Required)
 birthDate	Σ	0..1	date	The date on which the practitioner was born
 photo		0..*	Attachment	Image of the person
 qualification		0..*	BackboneElement	Certification, licenses, or training pertaining to the provision of care
 identifier		0..*	Identifier	An identifier for this qualification for the practitioner
 code		1..1	CodeableConcept	Coded representation of the qualification v2 table 0360, Version 2.7 (Example)
 period		0..1	Period	Period during which the qualification is valid
 issuer		0..1	Reference(Organization)	Organization that regulates and issues the qualification
 communication		0..*	CodeableConcept	A language the practitioner can use in patient communication Common Languages (Preferred) but limited to AllLanguages

22.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Practitioner",
  "profile": {
    "reference": "https://www.hl7.org/fhir/practitioner.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
  ]
}
```

```
{  
  "code": "update",  
  "documentation": "Update an existing resource by its id"  
},  
{  
  "code": "delete",  
  "documentation": "Delete a resource"  
},  
{  
  "code": "vread",  
  "documentation": "Read the state of a specific version of the resource"  
},  
{  
  "code": "patch"  
},  
{  
  "code": "history-instance",  
  "documentation": "Retrieve the change history for a particular resource."  
},  
{  
  "code": "history-type",  
  "documentation": "Retrieve the change history for all resources of a  
particular type"  
},  
{  
  "code": "search-type",  
  "documentation": "Search the resource type based on some filter criteria"  
}  
],
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{  
  "resourceType" : "Practitioner",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // An identifier for the person as this agent  
  "active" : <boolean>, // Whether this practitioner's record is in active use  
  "name" : [{ HumanName }], // The name(s) associated with the practitioner  
  "telecom" : [{ ContactPoint }], // A contact detail for the practitioner (that apply to all roles)  
  "address" : [{ Address }], // Address(es) of the practitioner that are not role specific (typically home address)  
  "gender" : "<code>", // male | female | other | unknown  
  "birthDate" : "<date>", // The date on which the practitioner was born  
  "photo" : [{ Attachment }], // Image of the person  
  "qualification" : [{ // Certification, licenses, or training pertaining to the provision of care
```

```
"identifier" : [{ Identifier }], // An identifier for this qualification for the practitioner
"code" : { CodeableConcept }, // R! Coded representation of the qualification
"period" : { Period }, // Period during which the qualification is valid
"issuer" : { Reference(Organization) } // Organization that regulates and issues the qualification
  ],
"communication" : [{ CodeableConcept }] // A language the practitioner can use in patient communication
}
```

22.3.3 Terminology Bindings

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

22.3.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "active",
    "type": "token"
  },
  {
    "name": "address",
    "type": "string"
  },
  {
    "name": "address-city",
    "type": "string"
  },
  {
    "name": "address-country",
    "type": "string"
  },
  {
    "name": "age",
    "type": "string"
  },
  {
    "name": "allergy",
    "type": "string"
  },
  {
    "name": "body-site",
    "type": "string"
  },
  {
    "name": "category",
    "type": "string"
  },
  {
    "name": "class",
    "type": "string"
  },
  {
    "name": "code",
    "type": "string"
  },
  {
    "name": "concept",
    "type": "string"
  },
  {
    "name": "display",
    "type": "string"
  },
  {
    "name": "distance",
    "type": "string"
  },
  {
    "name": "entity",
    "type": "string"
  },
  {
    "name": "extension",
    "type": "string"
  },
  {
    "name": "family-history",
    "type": "string"
  },
  {
    "name": "genetic",
    "type": "string"
  },
  {
    "name": "gender",
    "type": "string"
  },
  {
    "name": "genetic",
    "type": "string"
  },
  {
    "name": "group",
    "type": "string"
  },
  {
    "name": "id",
    "type": "string"
  },
  {
    "name": "language",
    "type": "string"
  },
  {
    "name": "location",
    "type": "string"
  },
  {
    "name": "name",
    "type": "string"
  },
  {
    "name": "note",
    "type": "string"
  },
  {
    "name": "operator",
    "type": "string"
  },
  {
    "name": "parent",
    "type": "string"
  },
  {
    "name": "product",
    "type": "string"
  },
  {
    "name": "qualification",
    "type": "string"
  },
  {
    "name": "related",
    "type": "string"
  },
  {
    "name": "resource",
    "type": "string"
  },
  {
    "name": "status",
    "type": "string"
  },
  {
    "name": "substance",
    "type": "string"
  },
  {
    "name": "text",
    "type": "string"
  },
  {
    "name": "type",
    "type": "string"
  },
  {
    "name": "value",
    "type": "string"
  }
]
```

```
        "name": "address-postalcode",
        "type": "string"
    },
    {
        "name": "address-state",
        "type": "string"
    },
    {
        "name": "address-use",
        "type": "token"
    },
    {
        "name": "communication",
        "type": "token"
    },
    {
        "name": "email",
        "type": "token"
    },
    {
        "name": "family",
        "type": "string"
    },
    {
        "name": "gender",
        "type": "token"
    },
    {
        "name": "given",
        "type": "string"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "name",
        "type": "string"
    },
    {
        "name": "phone",
        "type": "token"
    },
    {
        "name": "phonetic",
        "type": "string"
    },
    {
        "name": "telecom",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	Whether the practitioner record is active	Practitioner.active	
address	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text	Practitioner.address	3 Resources
address-city	string	A city specified in an address	Practitioner.address.city	3 Resources
address-country	string	A country specified in an address	Practitioner.address.country	3 Resources
address-postalcode	string	A postalCode specified in an address	Practitioner.address.postalCode	3 Resources
address-state	string	A state specified in an address	Practitioner.address.state	3 Resources
address-use	token	A use code specified in an address	Practitioner.address.use	3 Resources
communication	token	One of the languages that the practitioner can communicate with	Practitioner.communication	
email	token	A value in an email contact	Practitioner.telecom.where (system='email')	4 Resources

gender	token	Gender of the practitioner	Practitioner.gender	3	Resources
identifier	token	A practitioner's Identifier	Practitioner.identifier		
name	string	A server defined search that may match any of the string fields in the HumanName, including family, give, prefix, suffix, suffix, and/or text	Practitioner.name		
phone	token	A value in a phone contact	Practitioner.telecom.where (system='phone')	4	Resources

22.3.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/practitioner-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/practitioner-definitions.html
Mappings	http://hl7.org/fhir/R4/practitioner-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/practitioner-profiles.html

23 Practitioner Role

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/practitionerrole.html>

Definition: A specific set of Roles/Locations/specialties/services that a practitioner may perform at an organization for a period of time.

23.1 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 representing this data.

Where availability, telecom, or other details are not the same across all healthcareservices, or locations a separate PractitionerRole instance should be created.

23.1.1 Boundaries and Relationships

Qualifications (from the Practitioner resource) do not imply a Role, 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](#) 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](#), or functional role (e.g. 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).

23.2 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.

23.3 Resource Content

23.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 PractitionerRole	TU		DomainResource	Roles/organizations the practitioner is associated with Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	Business Identifiers that are specific to a role/location
 active	Σ	0..1	boolean	Whether this practitioner role record is in active use
 period	Σ	0..1	Period	The period during which the practitioner is authorized to perform in these role(s)
 practitioner	Σ	0..1	Reference(Practitioner)	Practitioner that is able to provide the defined services for the organization
 organization	Σ	0..1	Reference(Organization)	Organization where the roles are available
 code	Σ	0..*	CodeableConcept	Roles which this practitioner may perform Practitioner role (Example)
 specialty	Σ	0..*	CodeableConcept	Specific specialty of the practitioner Practice Setting Code Value Set (Preferred)

 location	Σ	0..*	Reference(Location)	The location(s) at which this practitioner provides care
 healthcareService		0..*	Reference(HealthcareService)	The list of healthcare services that this worker provides for this role's Organization/Location(s)
 telecom	Σ	0..*	ContactPoint	Contact details that are specific to the role/location/service
 availableTime		0..*	BackboneElement	Times the Service Site is available
 daysOfTheWeek		0..*	code	mon tue wed thu fri sat sun DaysOfTheWeek (Required)
 allDay		0..1	boolean	Always available? e.g. 24 hour service
 availableStartTime		0..1	time	Opening time of day (ignored if allDay = true)
 availableEndTime		0..1	time	Closing time of day (ignored if allDay = true)
 notAvailable		0..*	BackboneElement	Not available during this time due to provided reason
 description		1..1	string	Reason presented to the user explaining why time not available
 during		0..1	Period	Service not available from this date
 availabilityExceptions		0..1	string	Description of availability exceptions
 endpoint		0..*	Reference(Endpoint)	Technical endpoints providing access to services operated for the practitioner with this role

23.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
    "type": "PractitionerRole",  
    "profile": {  
        "reference": "http://www.hl7.org/fhir/PractitionerRole.html"  
    },  
    "interaction": [  
        {  
            "code": "read",  
            "documentation": "Read the current state of the resource"  
        },  
        {  
            "code": "create",  
            "documentation": "Create a new resource with a server assigned id"  
        },  
        {  
            "code": "update",  
            "documentation": "Update an existing resource by its id"  
        },  
        {  
            "code": "delete",  
            "documentation": "Delete a resource"  
        },  
        {  
            "code": "vread",  
            "documentation": "Read the state of a specific version of the resource"  
        },  
        {  
            "code": "patch"  
        },  
        {  
            "code": "history-instance",  
            "documentation": "Retrieve the change history for a particular resource."  
        },  
        {  
            "code": "history-type",  
            "documentation": "Retrieve the change history for all resources of a  
particular type"  
        },  
        {  
            "code": "search-type",  
            "documentation": "Search the resource type based on some filter criteria"  
        }  
    ],  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "PractitionerRole",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Business Identifiers that are specific to a role/location  
  "active" : <boolean>, // Whether this practitioner role record is in active use  
  "period" : { Period }, // The period during which the practitioner is authorized to perform in the se role(s)  
  "practitioner" : { Reference(Practitioner) }, // Practitioner that is able to provide the defined services for the organization  
  "organization" : { Reference(Organization) }, // Organization where the roles are available  
  "code" : [{ CodeableConcept }], // Roles which this practitioner may perform  
  "specialty" : [{ CodeableConcept }], // Specific specialty of the practitioner  
  "location" : [{ Reference(Location) }], // The location(s) at which this practitioner provides care  
  "healthcareService" : [{ Reference(HealthcareService) }], // The list of healthcare services that this worker provides for this role's Organization/Location(s)  
  "telecom" : [{ ContactPoint }], // Contact details that are specific to the role/location/service  
  "availableTime" : [{ // Times the Service Site is available  
    "daysOfWeek" : ["<code>"], // mon | tue | wed | thu | fri | sat | sun  
    "allDay" : <boolean>, // Always available? e.g. 24 hour service  
    "availableStartTime" : "<time>", // Opening time of day (ignored if allDay = true)  
    "availableEndTime" : "<time>" // Closing time of day (ignored if allDay = true)  
  }],  
  "notAvailable" : [{ // Not available during this time due to provided reason  
    "description" : "<string>", // R! Reason presented to the user explaining why time not available  
    "during" : { Period } // Service not available from this date  
  }],  
  "availabilityExceptions" : "<string>", // Description of availability exceptions  
  "endpoint" : [{ Reference(Endpoint) }]] // Technical endpoints providing access to services operated for the practitioner with this role  
}
```

23.3.3 Terminology Bindings

Path	Definition	Type	Reference
PractitionerRole.code	The role a person plays representing an organization.	Example	PractitionerRole
PractitionerRole.specialty	Specific specialty associated with the agency.	Preferred	PracticeSettingCodeValueSet
PractitionerRole.availableTime.daysOfWeek	The days of the week.	Required	DaysOfWeek

23.3.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "active",
    "type": "token"
  },
  {
    "name": "practitioner",
    "type": "reference"
  },
  {
    "name": "organization",
    "type": "reference"
  },
  {
    "name": "email",
    "type": "token"
  },
  {
    "name": "phone",
    "type": "token"
  },
  {
    "name": "telecom",
    "type": "token"
  },
  {
    "name": "date",
    "type": "date"
  },
  {
    "name": "endpoint",
    "type": "reference"
  }
],
```

```
{
  "name": "identifier",
  "type": "token"
},
{
  "name": "location",
  "type": "reference"
},
{
  "name": "role",
  "type": "token"
},
{
  "name": "service",
  "type": "reference"
},
{
  "name": "specialty",
  "type": "token"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	Whether this practitioner role record is in active use	PractitionerRole.active	
date	date	The period during which the practitioner is authorized to perform in these role(s)	PractitionerRole.period	
email	token	A value in an email contact	PractitionerRole.telecom.where 4 (system='email') Resources	
endpoint	reference	Technical endpoints providing access to services operated for the practitioner with this role	PractitionerRole.endpoint (Endpoint)	
identifier	token	A practitioner's Identifier	PractitionerRole.identifier	
location	reference	One of the locations at which this practitioner provides care	PractitionerRole.location (Location)	

organization [reference](#) The identity of the organization the practitioner represents / acts on behalf of [PractitionerRole.organization](#) ([Organization](#))

phone [token](#) A value in a phone contact [PractitionerRole.telecom.where](#) ([system='phone'](#)) [4 Resources](#)

practitioner [reference](#) Practitioner that is able to provide the defined services for the organization [PractitionerRole.practitioner](#) ([Practitioner](#))

role [token](#) The practitioner can perform this role at for the organization [PractitionerRole.code](#)

service [reference](#) The list of healthcare services that this worker provides for this role's Organization/Location(s) [PractitionerRole.healthcareService](#) ([HealthcareService](#))

specialty [token](#) The practitioner has this specialty at an organization [PractitionerRole.specialty](#)

telecom [token](#) The value in any kind of contact [PractitionerRole.telecom](#) [4 Resources](#)

23.3.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/practitionerrole-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/practitionerrole-definitions.html
Mappings	http://hl7.org/fhir/R4/practitionerrole-mappings.html

Profiles & Extensions	http://hl7.org/fhir/R4/practitionerrole-profiles.html
----------------------------------	---

24 Procedure

Note: the following sections reference the FHIR standards version R4 – <http://hl7.org/fhir/R4/procedure.html>

Definition: An action that is or was performed on or for a patient. This can be a physical intervention like an operation, or less invasive like long term services, counseling, or hypnotherapy.

24.1 Scope and Usage

Procedure is one of the [event](#) resources in the FHIR [workflow](#) specification.

This resource is used to record the details of current and historical procedures performed on or for a patient. A procedure is an activity that is performed on, with, or for a patient as part of the provision of care. Examples include surgical procedures, diagnostic procedures, endoscopic procedures, biopsies, counseling, physiotherapy, personal support services, adult day care services, non-emergency transportation, home modification, exercise, etc. Procedures may be performed by a healthcare professional, a service provider, 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.

24.1.1 Boundaries and Relationships

The Procedure resource should not be used to capture an event if a more specific resource already exists - i.e. [immunizations](#), [drug administrations](#) and [communications](#). The boundary between determining whether an action is a Procedure (training or counseling) 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](#) and [DiagnosticReports](#). 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 might not have a Procedure record. 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.)

A [Task](#) is a workflow step such as cancelling an order, fulfilling an order, signing an order, merging a set of records, admitting a patient. Procedures are actions that are intended to result in a physical or mental change to or for the subject (e.g. surgery, physiotherapy, training, counseling).

A [Task](#) resource often exists in parallel with clinical resources. For example, a [Task](#) might request fulfillment of a [ServiceRequest](#) ordering a Procedure.

24.2 Resource Content

24.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Procedure	TU		DomainResource	An action that is being or was performed on a patient Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	External Identifiers for this procedure

 instantiates	Σ	0..*	canonical(PlanDefinition ActivityDefinition Measure OperationDefinition Questionnaire)	Instantiates FHIR protocol or definition
 instantiates	Σ	0..*	uri	Instantiates external protocol or definition
 basedOn	Σ	0..*	Reference(CarePlan ServiceRequest)	A request for this procedure
 partOf	Σ	0..*	Reference(Procedure Observation MedicationAdministration)	Part of referenced event
 status	$?!\Sigma$	1..1	code	preparation in-progress not-done on-hold stopped completed entered-in-error unknown EventStatus (Required)
 statusReason	Σ	0..1	CodeableConcept	Reason for current status Procedure Not Performed Reason (SNOMED-CT) (Example)
 category	Σ	0..1	CodeableConcept	Classification of the procedure Procedure Category Codes (SNOMED CT) (Example)
 code	Σ	0..1	CodeableConcept	Identification of the procedure Procedure Codes (SNOMED CT) (Example)
 subject	Σ	1..1	Reference(Patient Group)	Who the procedure was performed on
 encounter	Σ	0..1	Reference(Encounter)	Encounter created as part of
 performedOn	Σ	0..1		When the procedure was performed

			dateTime	
	performed			
DateTime				
			Period	
	performedP			
Period				
			string	
	performed			
String				
			Age	
	performed			
Age				
			Range	
	performed			
Range				
	recorder	Σ	0..1	Reference(Patient RelatedPerson Practitioner PractitionerRole) Who recorded the procedure
	assertor	Σ	0..1	Reference(Patient RelatedPerson Practitioner PractitionerRole) Person who asserts this procedure
	performer	Σ	0..*	The people who performed the procedure
	function	Σ	0..1	Type of performance Procedure Performer Role Codes (Example)
	actor	Σ	1..1	Reference(Practitioner PractitionerRole Organization Patient RelatedPerson Device) The reference to the practitioner

 onBehalfOf	0..1	Reference(Organization)	Organization the device or practitioner was acting for
 location	Σ	0..1	Reference(Location) Where the procedure happened
 reasonCode	Σ	0..*	CodeableConcept Coded reason procedure performed Procedure Reason Codes (Example)
 reasonReference	Σ	0..*	Reference(Condition Observation Procedure Diagnostic Report DocumentReference) The justification that the procedure was performed
 bodySite	Σ	0..*	CodeableConcept Target body sites SNOMED CT Body Structures (Example)
 outcome	Σ	0..1	CodeableConcept The result of procedure Procedure Outcome Codes (SNOMED CT) (Example)
 report	0..*	Reference(DiagnosticReport DocumentReference Composition)	Any report resulting from the procedure
 complication	0..*	CodeableConcept	Complication following the procedure Condition/Problem/Diagnosis Codes (Example)
 complicationDetail	0..*	Reference(Condition)	A condition that is a result of the procedure
 followUp	0..*	CodeableConcept	Instructions for follow up Procedure Follow up Codes (SNOMED CT) (Example)
 note	0..*	Annotation	Additional information about the procedure
 focalDevice	0..*	BackboneElement	Manipulated, implanted, or removed device

 action	0..1	CodeableConcept	Kind of change to device Procedure Device Action Codes (Preferred)
 manipulate	1..1	Reference(Device)	Device that was changed
 usedReference	0..*	Reference(Device Medication Substance)	Items used during procedure
 usedCode	0..*	CodeableConcept	Coded items used during the procedure FHIR Device Types (Example)

24.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "ProcedureRequest",
  "profile": {
    "reference": "http://hl7.org/fhir/procedurerequest.html"
  },
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "vread"
    },
    {
      "code": "create"
    },
    {
      "code": "update"
    },
    {
      "code": "delete"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance"
    },
    {
      "code": "history-type"
    }
  ]
}
```

```
{  
  "code": "search-type"  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{  
  "resourceType" : "Procedure",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // External Identifiers for this procedure  
  "instantiatesCanonical" : [{ canonical(PlanDefinition|ActivityDefinition|Measure|OperationDefinition|Questionnaire) }], // Instantiates FHIR protocol or definition  
  "instantiatesUri" : ["<uri>"], // Instantiates external protocol or definition  
  "basedOn" : [{ Reference(CarePlan|ServiceRequest) }], // A request for this procedure  
  "partOf" : [{ Reference(Procedure|Observation|MedicationAdministration) }], // Part of referenced event  
  "status" : "<code>", // R! preparation | in-progress | not-done | on-hold | stopped | completed | entered-in-error | unknown  
  "statusReason" : { CodeableConcept }, // Reason for current status  
  "category" : { CodeableConcept }, // Classification of the procedure  
  "code" : { CodeableConcept }, // Identification of the procedure  
  "subject" : { Reference(Patient|Group) }, // R! Who the procedure was performed on  
  "encounter" : { Reference(Encounter) }, // Encounter created as part of  
  // performed[x]: When the procedure was performed. One of these 5:  
  "performedDateTime" : "<dateTime>",  
  "performedPeriod" : { Period },  
  "performedString" : "<string>",  
  "performedAge" : { Age },  
  "performedRange" : { Range },  
  "recorder" : { Reference(Patient|RelatedPerson|Practitioner|PractitionerRole) }, // Who recorded the procedure  
  "asserter" : { Reference(Patient|RelatedPerson|Practitioner|PractitionerRole) }, // Person who asserts this procedure
```

```
"performer" : [{ // The people who performed the procedure
  "function" : { CodeableConcept }, // Type of performance
  "actor" : { Reference(Practitioner|PractitionerRole|Organization|Patient|
    RelatedPerson|Device) }, // R! The reference to the practitioner
  "onBehalfOf" : { Reference(Organization) } // Organization the device or practitioner was acting
  for
},
"location" : { Reference(Location) }, // Where the procedure happened
"reasonCode" : [{ CodeableConcept }], // Coded reason procedure performed
"reasonReference" : [{ Reference(Condition|Observation|Procedure|
  DiagnosticReport|DocumentReference) }], // The justification that the procedure was performed
"bodySite" : [{ CodeableConcept }], // Target body sites
"outcome" : { CodeableConcept }, // The result of procedure
"report" : [{ Reference(DiagnosticReport|DocumentReference|Composition) }], // Any report resulting
  from the procedure
"complication" : [{ CodeableConcept }], // Complication following the procedure
"complicationDetail" : [{ Reference(Condition) }], // A condition that is a result of the procedure
"followUp" : [{ CodeableConcept }], // Instructions for follow up
"note" : [{ Annotation }], // Additional information about the procedure
"focalDevice" : [{ // Manipulated, implanted, or removed device
  "action" : { CodeableConcept }, // Kind of change to device
  "manipulated" : { Reference(Device) } // R! Device that was changed
},
"usedReference" : [{ Reference(Device|Medication|Substance) }], // Items used during procedure
"usedCode" : [{ CodeableConcept }] // Coded items used during the procedure
}
```

24.2.3 Terminology Bindings

Path	Definition	Type	Reference
Procedure.status	A code specifying the state of the procedure.	Required	EventStatus

Procedure.statusReason	A code that identifies the reason a procedure was not performed.	Example	ProcedureNotPerformedReason(SNOMED-CT)
Procedure.category	A code that classifies a procedure for searching, sorting and display purposes.	Example	ProcedureCategoryCodes(SNOMEDCT)
Procedure.code	A code to identify a specific procedure .	Example	ProcedureCodes(SNOMEDCT)
Procedure.performer.function	A code that identifies the role of a performer of the procedure.	Example	ProcedurePerformerRoleCodes
Procedure.reasonCode	A code that identifies the reason a procedure is required.	Example	ProcedureReasonCodes
Procedure.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMEDCTBodyStructures
Procedure.outcome	An outcome of a procedure - whether it was	Example	ProcedureOutcomeCodes(SNOMEDCT)

	resolved or otherwise.		
Procedure.complication	Codes describing complications that resulted from a procedure.	Example	Condition/Problem/DiagnosisCodes
Procedure.followUp	Specific follow up required for a procedure e.g. removal of sutures.	Example	ProcedureFollowUpCodes(SNOMEDCT)
Procedure.focalDevice.action	A kind of change that happened to the device during the procedure.	Preferred	ProcedureDeviceActionCodes
Procedure.usedCode	Codes describing items used during a procedure.	Example	FHIRDeviceTypes

24.2.4 Use of Procedure properties

Many of the elements of Procedure have inherent relationships and may 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".

24.2.5 Use of Procedure

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.

24.2.6 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "active",
    "type": "token"
  },
  {
    "name": "Status",
    "type": "token"
  },
  {
    "name": "subject",
    "type": "reference"
  },
  {
    "name": "encounter",
    "type": "reference"
  },
  {
    "name": "code",
    "type": "token"
  },
  {
    "name": "priority",
    "type": "token"
  },
  {
    "name": "authored",
    "type": "date"
  },
  {
    "name": "requester",
    "type": "reference"
  },
  {
    "name": "identifier",
    "type": "token"
  },
  {
    "name": "patient",
    "type": "reference"
  },
  {
    "name": "based-on",
    "type": "reference"
  },
  {
    "name": "body-site",
    "type": "token"
  }
].
```

```
  [
    {
      "name": "context",
      "type": "reference"
    },
    {
      "name": "definition",
      "type": "reference"
    },
    {
      "name": "intent",
      "type": "token"
    },
    {
      "name": "occurrence",
      "type": "date"
    },
    {
      "name": "performer",
      "type": "reference"
    },
    {
      "name": "performer-type",
      "type": "token"
    },
    {
      "name": "replaces",
      "type": "reference"
    },
    {
      "name": "requisition",
      "type": "token"
    },
    {
      "name": "specimen",
      "type": "reference"
    },
    {
      "name": "status",
      "type": "token"
    }
  ]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
Based -on	reference	A request for this procedure	Procedure.basedOn (CarePlan , ServiceRequest)	

category	token	Classification of the procedure	Procedure.category	
code	token	A code to identify a procedure	Procedure.code	13 Resources
date	date	When the procedure was performed	Procedure.performed	17 Resources
encounter	reference	Encounter created as part of (Encounter)	Procedure.encounter	12 Resources
identifier	token	A unique identifier for a procedure	Procedure.identifier	30 Resources
instantiates-canonical	reference	Instantiates FHIR protocol or definition	Procedure.instantiatesCanonical (Questionnaire , Measure , PlanDefinition , OperationDefinition , ActivityDefinition)	
instantiates-uri	uri	Instantiates external protocol or definition	Procedure.instantiatesUri	
location	reference	Where the procedure happened	Procedure.location (Location)	
part-of	reference	Part of referenced event	Procedure.partOf (Observation , Procedure , MedicationAdministration)	
patient	reference	Search by subject - a patient	Procedure.subject.where(resolve() is Patient) (Patient)	33 Resources

performer	reference	The reference to the practitioner	Procedure.performer.actor (Practitioner , Organization , Device , Patient , PractitionerRole , RelatedPerson)
reason-code	token	Coded reason procedure performed	Procedure.reasonCode
reason-reference	reference	The justification that the procedure was performed	Procedure.reasonReference (Condition , Observation , Procedure , DiagnosticReport , DocumentReference)
status	token	preparation in-progress not-done on-hold stopped completed entered-in-error unknown	Procedure.status
subject	reference	Search by subject	Procedure.subject (Group , Patient)

24.2.7 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/procedure-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/procedure-definitions.html
Mappings	http://hl7.org/fhir/R4/procedure-mappings.html

**Profiles &
Extensions**<http://hl7.org/fhir/R4/procedure-profiles.html>

25 Schedule

Note: the following sections reference the FHIR standards version R4 -
<http://hl7.org/fhir/R4/schedule.html>

Definition: A container for slots of time that may be available for booking appointments.

25.1 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 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, the [Timing](#) data type should be used for that purpose.

25.2 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 analogue 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.

25.2.1 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 includes 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.

25.2.2 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 an already-booked slot, but the server business rules will dictate whether overbooking is allowed, or whether the appointment may be given a higher precedence and allocated the overbooked slot.

25.3 Resource Content

25.3.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

<u>Name</u>	<u>Flags</u>	<u>Card.</u>	<u>Type</u>	<u>Description & Constraints</u> 
 Schedule	TU		DomainResource	A container for slots of time that may be available for booking appointments Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	External Ids for this item
 active	$?!\Sigma$	0..1	boolean	Whether this schedule is in active use
 serviceCategory	Σ	0..*	CodeableConcept	High-level category Service category (Example)
 serviceType	Σ	0..*	CodeableConcept	Specific service Service type (Example)
 specialty	Σ	0..*	CodeableConcept	Type of specialty needed Practice Setting Code Value Set (Preferred)
 actor	Σ	1..*	Reference(Patient) Practitioner PractitionerRole RelatedPerson Device HealthcareService Location	Resource(s) that availability information is being provided for

 Σ	0..1	Period	Period of time covered by schedule
 planningHorizon			
 comment	0..1	string	Comments on availability

25.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Schedule",
  "profile": {
    "reference": "http://hl7.org/fhir/R4/schedule.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    },
    {
      "code": "vread",
      "documentation": "Read the state of a specific version of the resource"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance",
      "documentation": "Retrieve the change history for a particular resource."
    },
    {
      "code": "history-type",
      "documentation": "Retrieve the change history for all resources of a
particular type"
    },
    {
      "code": "search-type",
      "documentation": "Search the resource type based on some filter criteria"
    }
  ]
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "Schedule",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // External IDs for this item  
  "active" : <boolean>, // Whether this schedule is in active use  
  "serviceCategory" : [{ CodeableConcept }], // High-level category  
  "serviceType" : [{ CodeableConcept }], // Specific service  
  "specialty" : [{ CodeableConcept }], // Type of specialty needed  
  "actor" : [{ Reference(Patient|Practitioner|PractitionerRole|RelatedPerson|Device|HealthcareService|Location) }], // R! Resource(s) that availability information is being provided for  
  "planningHorizon" : { Period }, // Period of time covered by schedule  
  "comment" : "<string>" // Comments on availability  
}
```

25.3.3 Terminology Bindings

Path	Definition	Type	Reference
Schedule.serviceCategory		Example	ServiceCategory
Schedule.serviceType		Example	ServiceType
Schedule.specialty	Additional details about where the content was created (e.g. clinical specialty).	Preferred	PracticeSettingCodeValueSet

25.3.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
    {
        "name": "active",
        "type": "token"
    },
    {
        "name": "date",
        "type": "date"
    },
    {
        "name": "actor",
        "type": "reference"
    },
    {
        "name": "service-category",
        "type": "token"
    },
    {
        "name": "identifier",
        "type": "token"
    },
    {
        "name": "service-type",
        "type": "token"
    },
    {
        "name": "specialty",
        "type": "token"
    }
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
active	token	Is the schedule in active use	Schedule.active	
actor	reference	The individual(Healthcare Service, Practitioner, Location, ...) to find a Schedule for	Schedule.actor (Practitioner , Device , Patient , Healthcare Service , PractitionerRole , RelatedPerson , Location)	
date	date	Search for Schedule resources that have a	Schedule.planningHorizon	

period that contains
this date specified

identifier	token	A Schedule Identifier	Schedule.identifier
service- category	token	High-level category	Schedule.serviceCategory
service- type	token	The type of appointments that can be booked into associated slot(s)	Schedule.serviceType
specialty	token	Type of specialty needed	Schedule.specialty

25.3.5 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/schedule-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/schedule-definitions.html
Mappings	http://hl7.org/fhir/R4/schedule-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/schedule-profiles.html

26 Service Request

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/servicerequest.html>

Definition: A record of a request for service such as diagnostic investigations, treatments, or operations to be performed.

26.1 Scope and Usage

This resource is a request resource from a FHIR workflow perspective - see [Workflow](#).

ServiceRequest is a record of a request for a procedure or diagnostic or other service to be planned, proposed, or performed, as distinguished by the `ServiceRequest.intent` field value, with or on a patient. The procedure will lead to either a [Procedure](#) or [DiagnosticReport](#), which in turn may reference one or more [Observations](#), which summarize the performance of the procedures and associated documentation such as observations, images, findings that are relevant to the treatment/management of the subject. This resource may be used to share relevant information required to support a referral or a transfer of care request from one practitioner or organization to another 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:

- diagnostic tests/studies
- endoscopic procedures
- counseling
- biopsies
- therapies (e.g., physio-, social-, psychological-)
- (exploratory) surgeries or procedures
- exercises
- specialist consultation and assessments
- community services
- nursing services
- pharmacist medication review, 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 principal intention of ServiceRequest is to support ordering procedures for one patient (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.

ServiceRequest supports all these usages. The service 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](#) may also be represented by this resource.

The general work flow that this resource facilitates is that a clinical system creates a service request. The service 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 service 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 ServiceRequest 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](#)

26.1.1 Boundaries and Relationships

ServiceRequest is a record of a proposal/plan or order for a service to be performed that would result in a [Procedure](#), [Observation](#), [DiagnosticReport](#), [ImagingStudy](#) or similar resource. In contrast to ServiceRequest, [Task](#) which spans both intent and event and tracks the execution through to completion and is intended for "administrative" actions like requesting and tracking things to be done to a record, or keeping track of a checklist of steps such to be performed as part of a fulfilment process. A ServiceRequest can be higher-level authorization that triggered the creation of Task, or it can be the "request" resource Task is seeking to fulfill.

ServiceRequest and [CommunicationRequest](#) are related. A CommunicationRequest is a request to merely disclose information. Whereas a ServiceRequest would be used to request information as part of 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. In some workflows both may exist. For example, upon receiving a `CommunicationRequest` a practitioner might initiate a `ServiceRequest`.

26.2 Resource Content

26.2.1 Structure

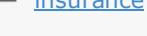
The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Service Request	ITU		DomainResource	<p>A request for a service to be performed</p> <p>+ <i>Rule: orderDetail SHALL only be present if code is present</i></p> <p>Elements defined in</p> <p>Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension</p>
 identifier	Σ	0..*	Identifier	Identifiers assigned to this order
 basedOn	Σ	0..*	Reference(CarePlan ServiceRequest MedicationRequest)	What request fulfills
 replaces	Σ	0..*	Reference(ServiceRequest)	What request replaces
 requisition	Σ	0..1	Identifier	Composite Request ID
 status	$?!\Sigma$	1..1	code	<p>draft active on-hold revoked completed entered-in-error unknown</p> <p>RequestStatus (Required)</p>
 intent	$?!\Sigma$	1..1	code	proposal plan directive order original-order reflex-order filler-

				order instance-order option RequestIntent (Required)
 category	Σ	0..*	CodeableConcept	Classification of service Service Request Category Codes (Example)
 priority	Σ	0..1	code	routine urgent asap stat Request priority (Required)
 doNotPerform	$?!\Sigma$	0..1	boolean	True if service/procedure should not be performed
 code	Σ	0..1	CodeableConcept	What is being requested/ordered Procedure Codes (SNOMED CT) (Example)
 orderDetail	ΣI	0..*	CodeableConcept	Additional order information Service Request Order Details Codes (Example)
 quantity[x]	Σ	0..1		Service amount
 quantityQua ntity			Quantity	
 quantityRatio			Ratio	
 quantityRan ge			Range	
 subject	Σ	1..1	Reference(Patient Group Location Device)	Individual or Entity the service is ordered for

 encounter	Σ	0..1	Reference(Encounter)	Encounter in which the request was created
 occurrence[x]	Σ	0..1		When service should occur
 occurrenceD atTime			dateTime	
 occurrenceP eriod			Period	
 occurrenceTi ming			Timing	
 asNeeded[x]	Σ	0..1		Preconditions for service SNOMED CT Medication As Needed Reason Codes (Example)
 asNeededBo olean			boolean	
 asNeededCo deableConcept			CodeableConcept	
 authoredOn	Σ	0..1	dateTime	Date request signed
 requester	Σ	0..1	Reference(Practitioner PractitionerRole Organization Patient RelatedPerson Device)	Who/what is requesting service
 performerTy pe	Σ	0..1	CodeableConcept	Performer role Participant Roles (Example)

  performer	Σ	0..*	Reference(Practitioner PractitionerRole Organization CareTeam HealthcareService Patient Device RelatedPerson)	Requested performer
  locationCode	Σ	0..*	CodeableConcept	Requested location V3 Value SetServiceDeliveryLocationRoleType (Example)
  locationReference	Σ	0..*	Reference(Location)	Requested location
  reasonCode	Σ	0..*	CodeableConcept	Explanation/Justification for procedure or service Procedure Reason Codes (Example)
  reasonReference	Σ	0..*	Reference(Condition Observation DiagnosticReport DocumentReference)	Explanation/Justification for service or service
  insurance		0..*	Reference(Coverage ClaimResponse)	Associated insurance coverage
  supportingInfo		0..*	Reference(Any)	Additional clinical information
  specimen	Σ	0..*	Reference(Specimen)	Procedure Samples
  bodySite	Σ	0..*	CodeableConcept	Location on Body SNOMED CT Body Structures (Example)
  note		0..*	Annotation	Comments
  patientInstruction	Σ	0..1	string	Patient or consumer-oriented instructions

 relevantHistory	0..*	Reference(Provenance)	Request provenance
---	------	---------------------------------------	--------------------

26.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
  "type": "ServiceRequest",  
  "profile": {  
    "reference": "https://www.hl7.org/fhir/servicerequest.html"  
  },  
  "interaction": [  
    {  
      "code": "read",  
      "documentation": "Read the current state of the resource"  
    },  
    {  
      "code": "create",  
      "documentation": "Create a new resource with a server assigned id"  
    },  
    {  
      "code": "update",  
      "documentation": "Update an existing resource by its id"  
    },  
    {  
      "code": "delete",  
      "documentation": "Delete a resource"  
    },  
    {  
      "code": "vread",  
      "documentation": "Read the state of a specific version of the resource"  
    },  
    {  
      "code": "patch"  
    },  
    {  
      "code": "history-instance",  
      "documentation": "Retrieve the change history for a particular resource."  
    },  
    {  
      "code": "history-type",  
      "documentation": "Retrieve the change history for all resources of a  
particular type"  
    },  
    {  
      "code": "search-type",  
      "documentation": "Search the resource type based on some filter criteria"  
    }  
  ]  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4).

Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "ServiceRequest",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // Identifiers assigned to this order  
  "instantiatesCanonical" : [{ canonical(ActivityDefinition|PlanDefinition) }], // Instantiates FHIR protocol or definition  
  "instantiatesUri" : ["<uri>"], // Instantiates external protocol or definition  
  "basedOn" : [{ Reference(CarePlan|ServiceRequest|MedicationRequest) }], // What request fulfills  
  "replaces" : [{ Reference(ServiceRequest) }], // What request replaces  
  "requisition" : { Identifier }, // Composite Request ID  
  "status" : "<code>", // R! draft | active | on-hold | revoked | completed | entered-in-error | unknown  
  "intent" : "<code>", // R! proposal | plan | directive | order | original-order | reflex-order | filler-order | instance-order | option  
  "category" : [{ CodeableConcept }], // Classification of service  
  "priority" : "<code>", // routine | urgent | asap | stat  
  "doNotPerform" : <boolean>, // True if service/procedure should not be performed  
  "code" : { CodeableConcept }, // What is being requested/ordered  
  "orderDetail" : [{ CodeableConcept }], // C? Additional order information  
  // quantity[x]: Service amount. One of these 3:  
  "quantityQuantity" : { Quantity },  
  "quantityRatio" : { Ratio },  
  "quantityRange" : { Range },  
  "subject" : { Reference(Patient|Group|Location|Device) }, // R! Individual or Entity the service is ordered for  
  "encounter" : { Reference(Encounter) }, // Encounter in which the request was created  
  // occurrence[x]: When service should occur. One of these 3:  
  "occurrenceDateTime" : "<dateTime>",  
  "occurrencePeriod" : { Period },  
  "occurrenceTiming" : { Timing },
```

```
// asNeeded[x]: Preconditions for service. One of these 2:  
"asNeededBoolean" : <boolean>,  
"asNeededCodeableConcept" : { CodeableConcept },  
"authoredOn" : "<dateTime>", // Date request signed  
"requester" : { Reference(Practitioner|PractitionerRole|Organization|  
Patient|RelatedPerson|Device) }, // Who/what is requesting service  
"performerType" : { CodeableConcept }, // Performer role  
"performer" : [{ Reference(Practitioner|PractitionerRole|Organization|  
CareTeam|HealthcareService|Patient|Device|RelatedPerson) }], // Requested performer  
"locationCode" : [{ CodeableConcept }], // Requested location  
"locationReference" : [{ Reference(Location) }], // Requested location  
"reasonCode" : [{ CodeableConcept }], // Explanation/Justification for procedure or service  
"reasonReference" : [{ Reference(Condition|Observation|DiagnosticReport|  
DocumentReference) }], // Explanation/Justification for service or service  
"insurance" : [{ Reference(Coverage|ClaimResponse) }], // Associated insurance coverage  
"supportingInfo" : [{ Reference(Any) }], // Additional clinical information  
"specimen" : [{ Reference(Specimen) }], // Procedure Samples  
"bodySite" : [{ CodeableConcept }], // Location on Body  
"note" : [{ Annotation }], // Comments  
"patientInstruction" : "<string>", // Patient or consumer-oriented instructions  
"relevantHistory" : [{ Reference(Provenance) }] // Request provenance  
}
```

26.2.3 Terminology Bindings

Path	Definition	Type	Reference
ServiceRequest.status	The status of a service order.	Required	RequestStatus
ServiceRequest.intent	The kind of service request.	Required	RequestIntent
ServiceRequest.category	Classification of the requested service.	Example	ServiceRequestCategoryCodes
ServiceRequest.priority	Identifies the level of importance to be assigned to actioning the request.	Required	RequestPriority

ServiceRequest.code	Codes for tests or services that can be carried out by a designated individual, organization or healthcare service. For laboratory, LOINC is (preferred)[http://build.fhir.org/terminologies.html#preferred] and a valueset using LOINC Order codes is available [here](valueset-diagnostic-requests.html).	Example	ProcedureCodes(SNOMEDCT)
ServiceRequest.orderDetail	Codified order entry details which are based on order context.	Example	ServiceRequestOrderDetailsCodes
ServiceRequest.asNeeded[x]	A coded concept identifying the precondition that should hold prior to performing a procedure. For example "pain", "on flare-up", etc.	Example	SNOMEDCTMedicationAsNeededReasonCodes
ServiceRequest.performerType	Indicates specific responsibility of an individual within the care team, such as "Primary physician", "Team coordinator", "Caregiver", etc.	Example	ParticipantRoles
ServiceRequest.locationCode	A location type where services are delivered.	Example	v3.ServiceDeliveryLocationRoleType
ServiceRequest.reasonCode	Diagnosis or problem codes justifying the reason for requesting the service investigation.	Example	ProcedureReasonCodes
ServiceRequest.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMEDCTBodyStructures

26.2.4 Constraints

id	Level	Location	Description	Expression

prr-1	Rule	(base)	orderDetail SHALL only be present if code is present	orderDetail.empty() or code.exists()
-------	----------------------	--------	--	--------------------------------------

26.2.5 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "authored",  
        "type": "date"  
    },  
    {  
        "name": "based-on",  
        "type": "reference"  
    },  
    {  
        "name": "body-site",  
        "type": "token"  
    },  
    {  
        "name": "category",  
        "type": "token"  
    },  
    {  
        "name": "code",  
        "type": "token"  
    },  
    {  
        "name": "encounter",  
        "type": "reference"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    },  
    {  
        "name": "instantiates-canonical",  
        "type": "reference"  
    },  
    {  
        "name": "instantiates-uri",  
        "type": "uri"  
    },  
    {  
        "name": "intent",  
        "type": "token"  
    },  
    {  
        "name": "occurrence",  
        "type": "date"  
    },  
    {  
        "name": "patient",  
        "type": "reference"  
    },  
    {  
        "name": "performer",  
        "type": "reference"  
    },  
]
```

```
{
  "name": "performer-type",
  "type": "token"
},
{
  "name": "priority",
  "type": "token"
},
{
  "name": "replaces",
  "type": "reference"
},
{
  "name": "requester",
  "type": "reference"
},
{
  "name": "requisition",
  "type": "token"
},
{
  "name": "specimen",
  "type": "reference"
},
{
  "name": "status",
  "type": "token"
},
{
  "name": "subject",
  "type": "reference"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
authored	date	Date request signed	ServiceRequest.authoredOn	
based-on	reference	What request fulfills	ServiceRequest.basedOn (CarePlan , MedicationRequest , ServiceRequest)	
body-site	token	Where procedure is going to be done	ServiceRequest.bodySite	
category	token	Classification of service	ServiceRequest.category	
code	token	What is being requested/ordered	ServiceRequest.code	13 Resources

encounter	reference	An encounter in which this request is made	ServiceRequest.encounter	11 Resources
identifier	token	Identifiers assigned to this order	ServiceRequest.identifier	29 Resources
intent	token	proposal plan directive order original-order reflex-order filler-order instance-order option	ServiceRequest.intent	
occurrence	date	When service should occur	ServiceRequest.occurrence	
patient	reference	Search by subject - a patient	ServiceRequest.subject.where(resolve() is Patient)	32 Resources
performer	reference	Requested performer	ServiceRequest.performer (Practitioner , Organization , CareTeam , Device , Patient , HealthcareService , PractitionerRole , RelatedPerson)	
performer-type	token	Performer role	ServiceRequest.performerType	
priority	token	routine urgent asap stat	ServiceRequest.priority	
replaces	reference	What request replaces	ServiceRequest.replaces (ServiceRequest)	

requester	reference	Who/what is requesting service	ServiceRequest.requester (Practitioner , Organization , Device , Patient , PractitionerRole , RelatedPerson)
requisition	token	Composite Request ID	ServiceRequest.requisition
specimen	reference	Specimen to be tested	ServiceRequest.specimen (Specimen)
status	token	draft active on-hold revoked completed entered-in-error unknown	ServiceRequest.status
subject	reference	Search by subject	ServiceRequest.subject (Group , Device , Patient , Location)

26.2.6 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/servicerequest-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/servicerequest-definitions.html
Mappings	http://hl7.org/fhir/R4/servicerequest-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/servicerequest-profiles.html

27 Slot

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/slot.html>

Definition: A slot of time on a schedule that may be available for booking appointments.

27.1 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.

27.2 Resource Content

27.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints 
 Slot	TU		DomainResource	A slot of time on a schedule that may be available for booking appointments Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 identifier	Σ	0..*	Identifier	External Ids for this item
 serviceCategory	Σ	0..*	CodeableConcept	A broad categorization of the service that is to be performed during this appointment Service category (Example)
 serviceType	Σ	0..*	CodeableConcept	The type of appointments that can be booked into this slot (ideally this would be an identifiable service - which is at a location, rather than the location itself). If provided then this overrides the value provided on the availability resource Service type (Example)
 specialty	Σ	0..*	CodeableConcept	The specialty of a practitioner that would be required to perform the service requested in this appointment Practice Setting Code Value Set (Preferred)

 appointment	Σ	0..1	CodeableConcept	The style of appointment or patient that may be booked in the slot (not service type) v2 Appointment Reason Codes (Preferred)
 schedule	Σ	1..1	Reference(Schedule)	The schedule resource that this slot defines an interval of status information
 status	Σ	1..1	code	busy free busy-unavailable busy-tentative entered-in-error SlotStatus (Required)
 start	Σ	1..1	instant	Date/Time that the slot is to begin
 end	Σ	1..1	instant	Date/Time that the slot is to conclude
 overbooked		0..1	boolean	This slot has already been overbooked, appointments are unlikely to be accepted for this time
 comment		0..1	string	Comments on the slot to describe any extended information. Such as custom constraints on the slot

27.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Slot",
  "profile": {
    "reference": "https://hl7.org/fhir/slot.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    }
  ]
}
```

```
{  
  "code": "vread",  
  "documentation": "Read the state of a specific version of the resource"  
},  
{  
  "code": "patch"  
},  
{  
  "code": "history-instance",  
  "documentation": "Retrieve the change history for a particular resource."  
},  
{  
  "code": "history-type",  
  "documentation": "Retrieve the change history for all resources of a  
particular type"  
},  
{  
  "code": "search-type",  
  "documentation": "Search the resource type based on some filter criteria"  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
?  
{  
  "resourceType" : "Slot",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "identifier" : [{ Identifier }], // External Ids for this item  
  "serviceCategory" : [{ CodeableConcept }], // A broad categorization of the service that is to be performed during this appointment  
  "serviceType" : [{ CodeableConcept }], // The type of appointments that can be booked into this slot (ideally this would be an identifiable service - which is at a location, rather than the location itself). If provided then this overrides the value provided on the availability resource  
  "specialty" : [{ CodeableConcept }], // The specialty of a practitioner that would be required to perform the service requested in this appointment  
  "appointmentType" : { CodeableConcept }, // The style of appointment or patient that may be booked in the slot (not service type)  
  "schedule" : { Reference(Schedule) }, // R! The schedule resource that this slot defines an interval of status information  
  "status" : "<code>", // R! busy | free | busy-unavailable | busy-tentative | entered-in-error  
  "start" : "<instant>", // R! Date/Time that the slot is to begin  
  "end" : "<instant>", // R! Date/Time that the slot is to conclude  
  "overbooked" : <boolean>, // This slot has already been overbooked, appointments are unlikely to be accepted for this time
```

```
  "comment" : "<string>" // Comments on the slot to describe any extended information. Such as custom constraints on the slot  
}
```

27.2.3 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "appointment-type",  
        "type": "token"  
    },  
    {  
        "name": "identifier",  
        "type": "token"  
    },  
    {  
        "name": "schedule",  
        "type": "reference"  
    },  
    {  
        "name": "service-category",  
        "type": "token"  
    },  
    {  
        "name": "service-type",  
        "type": "token"  
    },  
    {  
        "name": "specialty",  
        "type": "token"  
    },  
    {  
        "name": "start",  
        "type": "date"  
    },  
    {  
        "name": "status",  
        "type": "token"  
    }  
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
appointment-type	token	The style of appointment or patient that may be booked in the slot (not service type)	Slot.appointmentType	
identifier	token	A Slot Identifier	Slot.identifier	

schedule	reference	The Schedule Resource that we are seeking a slot within	Slot.schedule (Schedule)
service-category	token	A broad categorization of the service that is to be performed during this appointment	Slot.serviceCategory
service-type	token	The type of appointments that can be booked into the slot	Slot.serviceType
specialty	token	The specialty of a practitioner that would be required to perform the service requested in this appointment	Slot.specialty
start	date	Appointment date/time.	Slot.start
status	token	The free/busy status of the appointment	Slot.status

27.2.4 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/slot-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/slot-definitions.html
Mappings	http://hl7.org/fhir/R4/slot-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/slot-profiles.html

28 Subscription

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/subscription.html>

Definition: The subscription resource is used to define a push-based subscription from a server to another system. Once a subscription is registered with the server, the server checks every resource that is created or updated, and if the resource matches the given criteria, it sends a message on the defined "channel" so that another system can take an appropriate action.

28.1 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](#) 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 identified in the Subscription resource. 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 sent to the nominated email address or SMS number
- **message:** The resource is sent to the application identified in the URI as a [message](#)

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.

28.1.1 Boundaries and Relationships

As an alternative to subscriptions, the RESTful API describes a polling-based subscription method using [bundles](#) and the [history operation](#). 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.

When using the [Subscription](#) resource, the FHIR server combines the roles of publisher and information distributor. Other arrangements of the publish and subscribe pattern describe separate agents for the two roles. Implementers may implement the [Subscription](#) resource using an architecture with separate agents, or using any other pub/sub architecture (e.g. see [FHIRCast](#), or, more generally, [W3C Pub/Sub](#)).

28.2 Resource Content

28.2.1 Structure

The below chart displays an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Structure

Name	Flags	Card.	Type	Description & Constraints
 Subscription	ΣTU		Domain Resource	Server push subscription criteria Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 status	?!Σ	1..1	code	requested active error off SubscriptionStatus (Required)
 contact	Σ	0..*	ContactPoint	Contact details for source (e.g. troubleshooting)
 end	Σ	0..1	instant	When to automatically delete the subscription
 reason	Σ	1..1	string	Description of why this subscription was created
 criteria	Σ	1..1	string	Rule for server push
 error	Σ	0..1	string	Latest error note

	 channel	Σ	1..1	BackboneElement	The channel on which to report matches to the criteria
	 type	Σ	1..1	code	rest-hook websocket email sms message SubscriptionChannelType (Required)
	 endpoint	Σ	0..1	url	Where the channel points to
	 payload	Σ	0..1	code	MIME type to send, or omit for no payload MimeType (Required)
	 header	Σ	0..*	string	Usage depends on the channel type

28.2.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{
  "type": "Subscription",
  "profile": {
    "reference": "http://hl7.org/fhir/subscription.html"
  },
  "interaction": [
    {
      "code": "read",
      "documentation": "Read the current state of the resource"
    },
    {
      "code": "create",
      "documentation": "Create a new resource with a server assigned id"
    },
    {
      "code": "update",
      "documentation": "Update an existing resource by its id"
    },
    {
      "code": "delete",
      "documentation": "Delete a resource"
    },
    {
      "code": "vread",
      "documentation": "Read the state of a specific version of the resource"
    },
    {
      "code": "patch"
    },
    {
      "code": "history-instance",
      "documentation": "Retrieve the change history for a particular resource."
    },
    {
      "code": "history-type",
      "documentation": "Retrieve the change history for all resources of a
particular type"
    }
  ]
}
```

```

},
{
  "code": "search-type",
  "documentation": "Search the resource type based on some filter criteria"
}

```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```

{
  "resourceType" : "Subscription",
  // from Resource: id, meta, implicitRules, and language
  // from DomainResource: text, contained, extension, and modifierExtension
  "status" : "<code>", // R! requested | active | error | off
  "contact" : [{ ContactPoint }], // Contact details for source (e.g. troubleshooting)
  "end" : "<instant>", // When to automatically delete the subscription
  "reason" : "<string>", // R! Description of why this subscription was created
  "criteria" : "<string>", // R! Rule for server push
  "error" : "<string>", // Latest error note
  "channel" : { // R! The channel on which to report matches to the criteria
    "type" : "<code>", // R! rest-hook | websocket | email | sms | message
    "endpoint" : "<url>", // Where the channel points to
    "payload" : "<code>", // MIME type to send, or omit for no payload
    "header" : ["<string>"] // Usage depends on the channel type
  }
}

```

28.2.3 Terminology Bindings

Path	Definition	Type	Reference
Subscription.status	The status of a subscription.	Required	SubscriptionStatus
Subscription.channel.type	The type of method used to execute a subscription.	Required	SubscriptionChannelType

Subscription.channel.payload	The mime type of an attachment. Any valid mime type is allowed.	Required	Mime Types
------------------------------	--	--------------------------	----------------------------

28.2.4 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 processes. 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](#).

28.2.5 Managing Subscriptions and Errors

A subscription is defined by creating the Subscription resource 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.

When the server receives a subscription, it SHOULD check that it is prepared to accept/process the subscription. If it is, it sets the subscription to `active`, and then process it like a normal `create`. If it isn't, it SHOULD return an error with an [OperationOutcome](#) instead of processing the `create`.

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.

28.2.6 Tracking Subscription Notifications

Applications that wish to track whether notifications have been sent for particular resources (or versions of resources) can look at the AuditEvent resources. For example:

```
GET [base]/AuditEvent?entity=Patient/103
```

In addition, servers might also create [Communication](#) resources for some of the notifications that are sent in response to a subscription, such as when sending emails.

```
GET [base]/Communication?based-on=Subscription/103
```

This returns a list of communications sent by a subscription. TODO: search on payload....

28.2.7 Channels

More details on FHIR channel standards can be accessed here - <http://hl7.org/fhir/R4/subscription.html> in section [2.46.7](#).

28.2.8 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [
  {
    "name": "contact",
    "type": "token"
  },
  {
    "name": "criteria",
    "type": "string"
  },
  {
    "name": "payload",
    "type": "token"
  },
  {
    "name": "status",
    "type": "token"
  },
  {
    "name": "type",
    "type": "token"
  }
],
```

```
{
  "name": "url",
  "type": "url"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
contact	token	Contact details for the subscription	Subscription.contact	
criteria	string	The search rules used to determine when to send a notification	Subscription.criteria	
payload	token	The mime-type of the notification payload	Subscription.channel.payload	
status	token	The current state of the subscription	Subscription.status	
type	token	The type of channel for the sent notifications	Subscription.channel.type	
url	uri	The uri that will receive the notifications	Subscription.channel.endpoint	

28.2.9 Additional Information

Access the following links for additional information regarding FHIR compliance standards.

Category	Link
Examples	http://hl7.org/fhir/R4/subscription-examples.html
Detailed Descriptions	http://hl7.org/fhir/R4/subscription-definitions.html
Mappings	http://hl7.org/fhir/R4/subscription-mappings.html
Profiles & Extensions	http://hl7.org/fhir/R4/subscription-profiles.html

29 Value Set

Note: the following sections reference the FHIR standards version R4 - <http://hl7.org/fhir/R4/valueset.html>

Definition: A ValueSet resource instance specifies a set of codes drawn from one or more code systems, intended for use in a particular context. Value sets link between [CodeSystem](#) definitions and their use in [coded elements](#).

29.1 Scope and Usage

The FHIR terminology specification is based on two key concepts, originally defined in [HL7 v3 Core Principles](#):

- [CodeSystem](#) - declares the existence of and describes a code system or code system supplement and its key properties, and optionally defines a part or all of its content. Also known as Ontology, Terminology, or Enumeration
- [ValueSet](#) - specifies a set of codes drawn from one or more code systems, intended for use in a particular context. Value sets link between [CodeSystem](#) definitions and their use in [coded elements](#)

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") - see [Value Set Expansion](#)

The `ValueSet` resource can carry either the `.compose` or the `.expansion`, both of them, or neither of them (if only the metadata is being represented). There is an ["\\$expand" operation](#) which can be used to ask a server to generate an expansion given the composition rules, in a particular context, and a ["\\$validate-code" operation](#) which can be used to ask a server to check whether a given code or concept is in the value set in a particular context.

29.1.1 Boundaries and Relationships

Value Sets are used by many resources:

- Value sets use [CodeSystem](#) resources by referring to them via their canonical reference.
- Value sets are used in [StructureDefinition](#), [OperationDefinition](#), [Questionnaire](#), and other resources to specify the allowable contents for coded elements, or business rules for data processing
- [ConceptMap resources](#) describe mappings between value sets
- [DataRequirement](#) data types to specify data processing conditions

For a full list of uses, see below.

The Characteristics of the `ValueSet` resource are derived from Formal Value Set Definitions:

- The `ValueSet` resource design is based on the functionality described in the [OMG CTS 2](#) specification, along with metadata in the HL7 Value Set Definition specification. Value set resources can be converted to CTS2 value set or code system instances.
- The value set resource is aligned with the [Value Set Definition](#) (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](#). In the `ValueSet` resource, the `compose` element is the VSD "Content Logical definition".

29.2 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](#).

29.2.1 ValueSet Identification

A value set has 3 identifiers:

- **ValueSet.id**: the [logical 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. The element is named [url](#) rather than [uri](#) for legacy reasons and to strongly encourage providing a resolvable URL as the identifier whenever possible. Ideally, it should be a literal URL that is 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](#) specification)

In addition, any expansion for the value set also has **ValueSet.expansion.identifier** which uniquely identifies each expansion. For further information regarding resource identification, see [Resource Identity](#).

This means that each value set has 2 different URLs that can be used to reference it - its canonical URL (the [url](#) element), and its local location from which it may be retrieved (which includes the [id](#) element). 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 location ("literal") URI which is the URL where 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 current 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](#) template or [HL7 v3](#) 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.

29.2.2 Intensional vs Extensional

A value set may be described as intensional or extensional. The terms intensional and extensional come from the fields of mathematical logic and set theory.

An intensional value set is typically algorithmically defined. That is, the code group is defined as a rule e.g. all codes with the word diabetes in their description). The key benefit of intensional code groups is that they can be dynamically updated. Dynamic updating helps healthcare organizations keep current when new drugs (and their associated codes) become available or codes for diseases and other clinical concepts change. An intensional value set designed to contain all of the drugs in the beta blocker category can automatically receive a new beta blocker's code as soon as it hits the market.

Extensional value sets, meanwhile, are enumerated lists of codes where each code is listed individually. This gives the author and user of the value set more control over the which codes are in the value set, but there is a greater maintenance burden to ensure that the value set is kept up to date.

29.3 Resource Content

29.3.1 Structure

Access the following link <http://hl7.org/fhir/R4/valueset.html#resource> to view an exhaustive structure example as per FHIR R4 standards. Features mentioned are not all applicable to RamSoft.

Name	Flags	Card.	Type	Description & Constraints 
 ValueSet	IN		DomainResource	A set of codes drawn from one or more code systems + <i>Warning: Name should be usable as an identifier for the module by machine processing applications such as code generation</i> Элементы, определённые в родительском элементе: id , meta , implicitRules , language , text , contained , extension , modifierExtension
 url	Σ	0..1	uri	Canonical identifier for this value set, represented as a URI (globally unique)
 identifier	Σ	0..*	Identifier	Additional identifier for the value set (business identifier)
 version	Σ	0..1	string	Business version of the value set
 name	ΣI	0..1	string	Name for this value set (computer friendly)
 title	Σ	0..1	string	Name for this value set (human friendly)
 status	$?\Sigma$	1..1	code	draft active retired unknown PublicationStatus (Required)
 experimental	Σ	0..1	boolean	For testing purposes, not real usage
 date	Σ	0..1	dateTime	Date last changed
 publisher	Σ	0..1	string	Name of the publisher (organization or individual)

 contact	Σ	0..*	ContactDetail	Contact details for the publisher
 description		0..1	markdown	Natural language description of the value set
 useContext	Σ TU	0..*	UsageContext	The context that the content is intended to support
 jurisdiction	Σ	0..*	CodeableConcept	Intended jurisdiction for value set (if applicable) Jurisdiction (Extensible)
 immutable	Σ	0..1	boolean	Indicates whether or not any change to the content logical definition may occur
 purpose		0..1	markdown	Why this value set is defined
 copyright		0..1	markdown	Use and/or publishing restrictions
 compose		0..1	BackboneElement	Content logical definition of the value set (CLD)
 lockedDate	Σ	0..1	date	Fixed date for references with no specified version (transitive)
 inactive	Σ	0..1	boolean	Whether inactive codes are in the value set
 include	ΣI	1..*	BackboneElement	Include one or more codes from a code system or other value set(s) + Rule: A value set include/exclude SHALL have a value set or a system + Rule: A value set with concepts or filters SHALL include a system + Rule: Cannot have both concept and filter
 system	ΣI	0..1	uri	The system the codes come from
 version	Σ	0..1	string	Specific version of the code system referred to
 concept	I	0..*	BackboneElement	A concept defined in the system
 code		1..1	code	Code or expression from system
 display		0..1	string	Text to display for this code for this value set in this valueset
 language		0..*	BackboneElement	Additional representations for this concept
 language		0..1	code	Human language of the designation Common Languages (Preferred) but limited to AllLanguages
 use		0..1	Coding	Types of uses of designations Designation Use (Extensible)
 value		1..1	string	The text value for this designation
 filter	ΣI	0..*	BackboneElement	Select codes/concepts by their properties (including relationships)
 property	Σ	1..1	code	A property/filter defined by the code system
 op	Σ	1..1	code	= is-a descendant-of is-not-a regex in not-in generalizes exists FilterOperator (Required)
 value	Σ	1..1	string	Code from the system, or regex criteria, or boolean value for exists
 valueSet	ΣI	0..*	canonical(ValueSet)	Select the contents included in this value set

	 exclude	I	0..*	see include	Explicitly exclude codes from a code system or other value sets Used when the value set is "expanded"
	 expansion		0..1	BackboneElement	
	 identifier		0..1	uri	Identifies the value set expansion (business identifier)
	 timestamp		1..1	dateTime	Time ValueSet expansion happened
	 total		0..1	integer	Total number of codes in the expansion
	 offset		0..1	integer	Offset at which this resource starts
	 parameter		0..*	BackboneElement	Parameter that controlled the expansion process
	 name		1..1	string	Name as assigned by the client or server
	 value[x]		0..1		Value of the named parameter
	valueString			string	
	valueBoolean			boolean	
	valueInteger			integer	
	valueDecimal			decimal	
				uri	
	valueCode			code	
	valueDateTime			dateTime	
	 contains	I	0..*	BackboneElement	Codes in the value set + Rule: SHALL have a code or a display + Rule: Must have a code if not abstract + Rule: Must have a system if a code is present
	 system		0..1	uri	System value for the code
	 abstract		0..1	boolean	If user cannot select this entry
	 inactive		0..1	boolean	If concept is inactive in the code system
	 version		0..1	string	Version in which this code/display is defined
	 code	I	0..1	code	Code - if blank, this is not a selectable code
	 display	I	0..1	string	User display for the concept
	 designation		0..*	see designation	Additional representations for this item
	 contains		0..*	see contains	Codes contained under this entry

29.3.2 JSON

Below are the FHIR R4 compliant features supported by RamSoft in JSON format.

```
{  
    "type": "ValueSet",  
    "profile": {  
        "reference": "http://www.hl7.org/fhir/ValueSet.html"  
    },  
    "interaction": [  
        {  
            "code": "read",  
            "documentation": "Read the current state of the resource"  
        },  
        {  
            "code": "create",  
            "documentation": "Create a new resource with a server assigned id"  
        },  
        {  
            "code": "update",  
            "documentation": "Update an existing resource by its id"  
        },  
        {  
            "code": "delete",  
            "documentation": "Delete a resource"  
        },  
        {  
            "code": "vread",  
            "documentation": "Read the state of a specific version of the resource"  
        },  
        {  
            "code": "patch"  
        },  
        {  
            "code": "history-instance",  
            "documentation": "Retrieve the change history for a particular resource."  
        },  
        {  
            "code": "history-type",  
            "documentation": "Retrieve the change history for all resources of a  
particular type"  
        },  
        {  
            "code": "search-type",  
            "documentation": "Search the resource type based on some filter criteria"  
        }  
    ]  
}
```

The following displays an exhaustive sample list of features in JSON format compliant with FHIR standards (R4). Note: not all are supported by RamSoft.

JSON Template

```
{ ?  
  "resourceType" : "ValueSet",  
  // from Resource: id, meta, implicitRules, and language  
  // from DomainResource: text, contained, extension, and modifierExtension  
  "url" : "<uri>", // Canonical identifier for this value set, represented as a URI (globally unique  
}  
  "identifier" : [{ Identifier }], // Additional identifier for the value set (business identifier)  
  "version" : "<string>", // Business version of the value set  
  "name" : "<string>", // C? Name for this value set (computer friendly)  
  "title" : "<string>", // Name for this value set (human friendly)  
  "status" : "<code>", // R! draft | active | retired | unknown  
  "experimental" : <boolean>, // For testing purposes, not real usage  
  "date" : "<dateTime>", // Date last changed  
  "publisher" : "<string>", // Name of the publisher (organization or individual)  
  "contact" : [{ ContactDetail }], // Contact details for the publisher  
  "description" : "<markdown>", // Natural language description of the value set  
  "useContext" : [{ UsageContext }], // The context that the content is intended to support  
  "jurisdiction" : [{ CodeableConcept }], // Intended jurisdiction for value set (if applicable)  
  "immutable" : <boolean>, // Indicates whether or not any change to the content logical definition may occur  
  "purpose" : "<markdown>", // Why this value set is defined  
  "copyright" : "<markdown>", // Use and/or publishing restrictions  
  "compose" : { // Content logical definition of the value set (CLD)  
    "lockedDate" : "<date>", // Fixed date for references with no specified version (transitive)  
    "inactive" : <boolean>, // Whether inactive codes are in the value set  
    "include" : [{ // R! Include one or more codes from a code system or other value set(s)  
      "system" : "<uri>", // C? The system the codes come from  
      "version" : "<string>", // Specific version of the code system referred to  
      "concept" : [{ // C? A concept defined in the system  
        "code" : "<code>", // R! Code or expression from system  
        "display" : "<string>", // Text to display for this code for this value set in this valueset
```

```
"designation" : [{ // Additional representations for this concept
  "language" : "<code>", // Human language of the designation
  "use" : { Coding }, // Types of uses of designations
  "value" : "<string>" // R! The text value for this designation
}
],
"filter" : [{ // C? Select codes/concepts by their properties (including relationships)
  "property" : "<code>", // R! A property/filter defined by the code system
  "op" : "<code>", // R! = | is-a | descendant-of | is-not-a | regex | in | not-in | generalizes | exists
  "value" : "<string>" // R! Code from the system, or regex criteria, or boolean value for exists
},
{
  "valueSet" : [{ canonical(ValueSet) }] // C? Select the contents included in this value set
},
"exclude" : [{ Content as for ValueSet.compose.include }] // C? Explicitly exclude codes from a code system or other value sets
},
"expansion" : { // Used when the value set is "expanded"
  "identifier" : "<uri>", // Identifies the value set expansion (business identifier)
  "timestamp" : "<dateTime>", // R! Time ValueSet expansion happened
  "total" : <integer>, // Total number of codes in the expansion
  "offset" : <integer>, // Offset at which this resource starts
  "parameter" : [{ // Parameter that controlled the expansion process
    "name" : "<string>", // R! Name as assigned by the client or server
    // value[x]: Value of the named parameter. One of these 7:
    "valueString" : "<string>"
    "valueBoolean" : <boolean>
    "valueInteger" : <integer>
    "valueDecimal" : <decimal>
    "valueUri" : "<uri>"
    "valueCode" : "<code>"
    "valueDateTime" : "<dateTime>"
  }],
  "contains" : [{ // Codes in the value set
    "system" : "<uri>", // System value for the code
  }]
}
```

```
"abstract" : <boolean>, // If user cannot select this entry
"inactive" : <boolean>, // If concept is inactive in the code system
"version" : "<string>", // Version in which this code/display is defined
"code" : "<code>", // C? Code - if blank, this is not a selectable code
"display" : "<string>", // C? User display for the concept
"designation" : [{ Content as for ValueSet.compose.include.concept.designation }], // Additional representations for this item
"contains" : [{ Content as for ValueSet.expansion.contains }] // Codes contained under this entry
}]
}
}
```

29.3.3 Terminology Bindings

Path	Definition	Type	Reference
ValueSet.status	The lifecycle status of an artifact.	Required	PublicationStatus
ValueSet.jurisdiction	Countries and regions within which this artifact is targeted for use.	Extensible	Jurisdiction ValueSet
ValueSet.compose.include.concept.designation.language	A human language.	Preferred, but limited to AllLanguage	CommonLanguage s
ValueSet.compose.include.concept.designation.use	Details of how a	Extensible	DesignationUse

	designatio n would be used.		
ValueSet.compose.include.filter.op	The kind of operation to perform as a part of a property based filter.	Required	FilterOperator

29.3.4 Constraints

id	Level	Location	Description	Expression
vsd-0	Warning	(base)	Name should be usable as an identifier for the module by machine processing applications such as code generation	<code>name.matches(' [A- Z] ([A-Za-z0- 9_]) {0,254} ')</code>
vsd-1	Rule	ValueSet.compose.include	A value set include/exclude SHALL have a value set or a system	<code>valueSet.exists() or system.exists()</code>
vsd-2	Rule	ValueSet.compose.include	A value set with concepts or filters SHALL include a system	<code>(concept.exists() or filter.exists()) implies system.exists()</code>
vsd-3	Rule	ValueSet.compose.include	Cannot have both concept and filter	<code>concept.empty() or filter.empty()</code>

vsd-6	Rule	ValueSet.expansion.contains	SHALL have a code or a display	code.exists() or display.exists()
vsd-9	Rule	ValueSet.expansion.contains	Must have a code if not abstract	code.exists() or abstract = true
vsd-10	Rule	ValueSet.expansion.contains	Must have a system if a code is present	code.empty() or system.exists()

29.3.4 Search Parameters

The following details RamSoft's applicable Search Parameters.

```
"searchParam": [  
    {  
        "name": "code",  
        "type": "token"  
    },  
    {  
        "name": "context",  
        "type": "token"  
    },  
    {  
        "name": "context-quantity",  
        "type": "quantity"  
    },  
    {  
        "name": "context-type",  
        "type": "token"  
    },  
    {  
        "name": "context-type-quantity",  
        "type": "composite"  
    },  
    {  
        "name": "context-type-value",  
        "type": "composite"  
    },  
    {  
        "name": "date",  
        "type": "date"  
    },  
    {  
        "name": "description",  
        "type": "string"  
    },  
    {  
        "name": "expansion",  
        "type": "uri"  
    },  
    {  
        "name": "id",  
        "type": "token"  
    },  
    {  
        "name": "language",  
        "type": "token"  
    },  
    {  
        "name": "profile",  
        "type": "uri"  
    },  
    {  
        "name": "status",  
        "type": "token"  
    },  
    {  
        "name": "text",  
        "type": "string"  
    },  
    {  
        "name": "type",  
        "type": "token"  
    },  
    {  
        "name": "url",  
        "type": "uri"  
    },  
    {  
        "name": "value",  
        "type": "string"  
    }]
```

```
{
  "name": "identifier",
  "type": "token"
},
{
  "name": "jurisdiction",
  "type": "token"
},
{
  "name": "name",
  "type": "string"
},
{
  "name": "publisher",
  "type": "string"
},
{
  "name": "reference",
  "type": "uri"
},
{
  "name": "status",
  "type": "token"
},
{
  "name": "title",
  "type": "string"
},
{
  "name": "url",
  "type": "uri"
},
{
  "name": "version",
  "type": "token"
}
]
```

The below content displays an exhaustive sample list of search parameters as per FHIR R4 standards.

Name	Type	Description	Expression	In Common
code TU	token	This special parameter searches for codes in the value set. See additional notes on the ValueSet resource	ValueSet.expansion.contains.code ValueSet.compose.include.concept.code	
context TU	token	A use context assigned to the value set	(ValueSet.useContext.value as CodeableConcept)	

context-quantity TU	quantity	A quantity- or range-valued use context assigned to the value set	(ValueSet.useContext.value as Quantity) (ValueSet.useContext.value as Range)
----------------------------	--------------------------	---	--

context-type TU	token	A type of use context assigned to the value set	ValueSet.useContext.code
------------------------	-----------------------	---	--------------------------

context-type-quantity TU	composite	A use context type and quantity- or range-based value assigned to the value set	On ValueSet.useContext: context-type: code context-quantity: value.as(Quantity) value.as(Range)
---------------------------------	---------------------------	---	---

context-type-value TU	composite	A use context type and value assigned to the value set	On ValueSet.useContext: context-type: code context: value.as(CodeableConcept)
------------------------------	---------------------------	--	---

date TU	date	The value set publication date	ValueSet.date
----------------	----------------------	--------------------------------	---------------

description TU	string	The description of the value set	ValueSet.description
-----------------------	------------------------	----------------------------------	----------------------

expansion TU	uri	Identifies the value set expansion (business identifier)	ValueSet.expansion.identifier
---------------------	---------------------	--	-------------------------------

identifier TU	token	External identifier for the value set	ValueSet.identifier
----------------------	-----------------------	---------------------------------------	---------------------

jurisdiction TU	token	Intended jurisdiction for the value set	ValueSet.jurisdiction
------------------------	-----------------------	---	-----------------------

name	TU	string	Computationally friendly name of the value set	ValueSet.name
publisher	TU	string	Name of the publisher of the value set	ValueSet.publisher
reference	TU	uri	A code system included or excluded in the value set or an imported value set	ValueSet.compose.include.system
status	TU	token	The current status of the value set	ValueSet.status
title	TU	string	The human-friendly name of the value set	ValueSet.title
url	TU	uri	The uri that identifies the value set	ValueSet.url
version	TU	token	The business version of the value set	ValueSet.version
