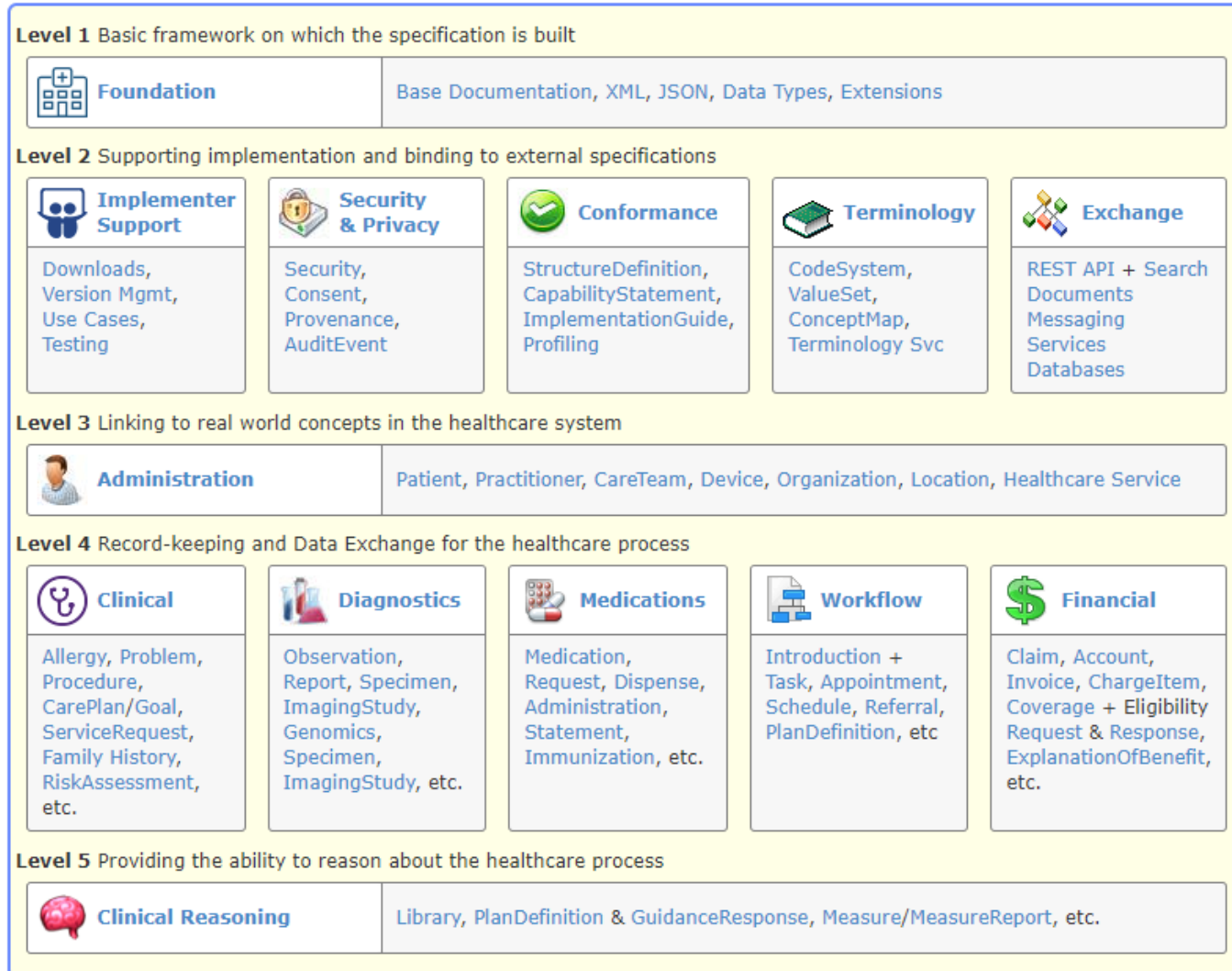


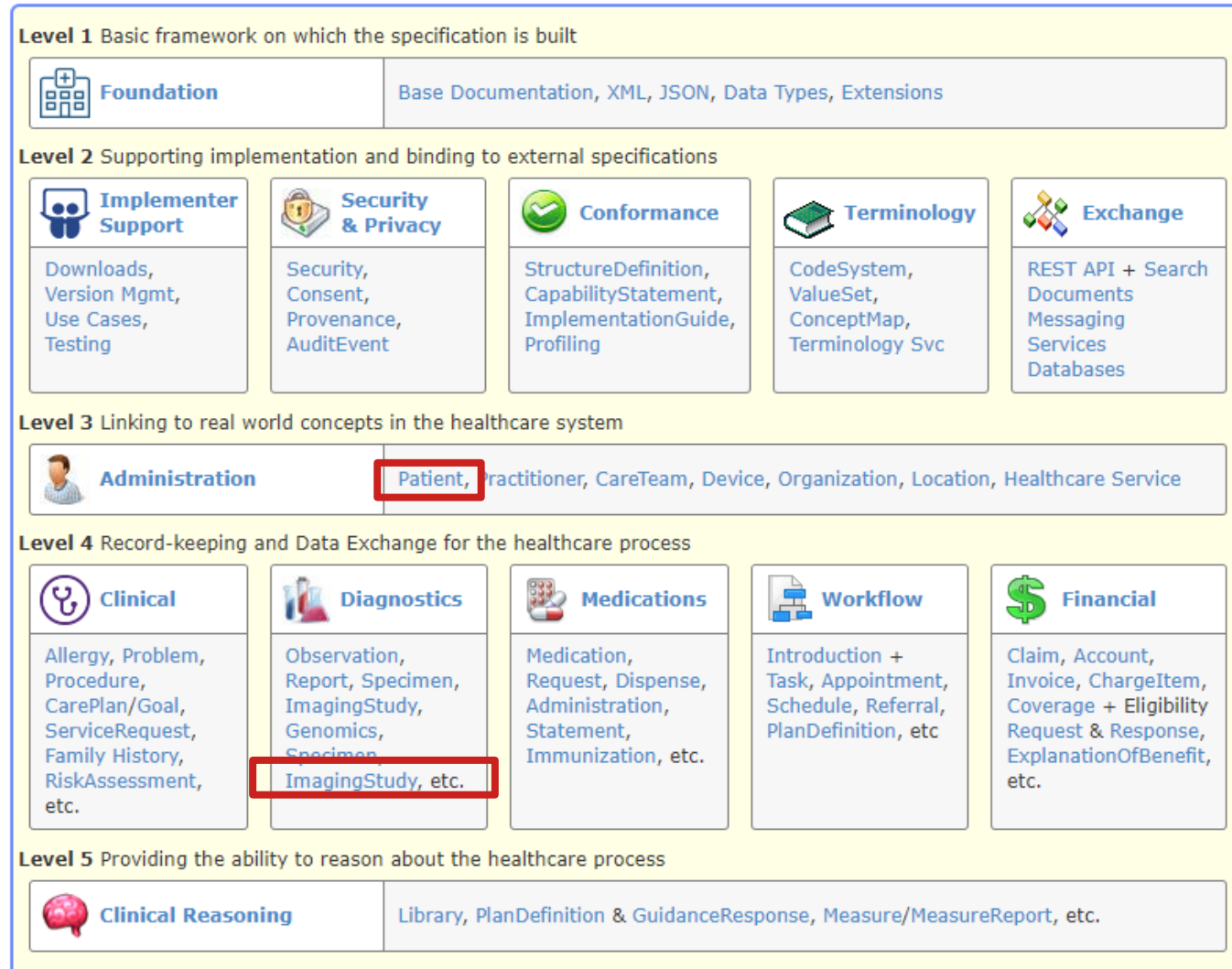


**Orthanc on FHIR**  
Sébastien Jodogne

# Minimal FHIR server for medical imaging

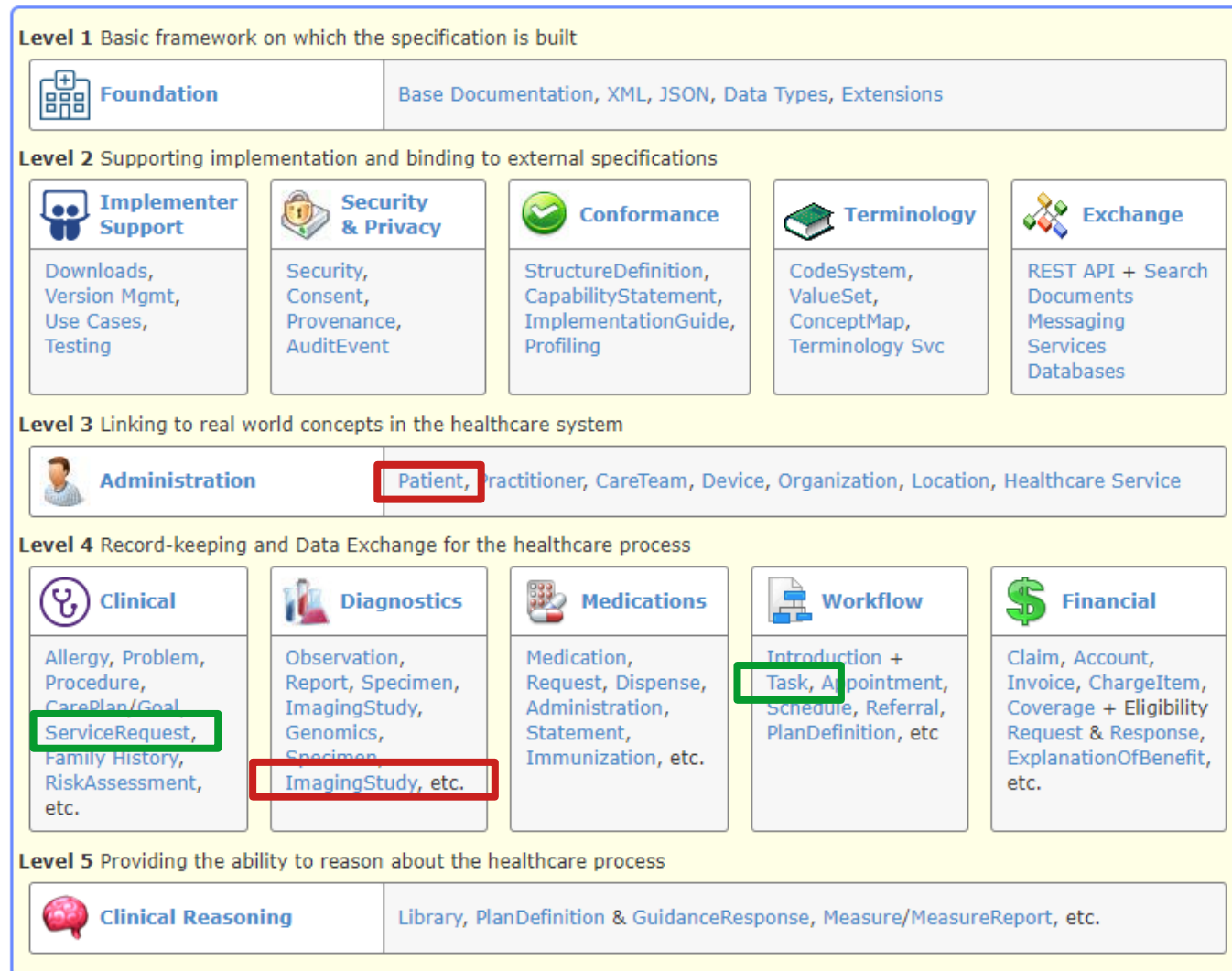


# Minimal FHIR server for medical imaging



For imaging studies:  
- Patient  
- ImagingStudy

# Minimal FHIR server for medical imaging




















For imaging studies:  
- Patient  
- ImagingStudy

For DICOM worklists:  
- ServiceRequest  
- Task  
→ GNU Health as a RIS?



# A brief overview of ImagingStudy

Name	Flags	Card.	Type	Description & Constraints
 ImagingStudy	<b>TU</b>		DomainResource	A set of images produced in single study (one or more series of references images)  Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a> , <a href="#">implicitRules</a> , <a href="#">language</a> , <a href="#">text</a> , <a href="#">contained</a> , <a href="#">extension</a> , <a href="#">modifierExtension</a>
 identifier	$\Sigma$	0..*	Identifier	Identifiers for the whole study
 status	?! $\Sigma$	1..1	code	registered   available   cancelled   entered-in-error   unknown Binding: <a href="#">Imaging Study Status (Required)</a>
 modality	$\Sigma$	0..*	CodeableConcept	All of the distinct values for series' modalities Binding: <a href="#">Modality</a> <a href="#">(Extensible)</a>
 subject	$\Sigma$	1..1	Reference(Patient   Device   Group)	Who or what is the subject of the study
 encounter	$\Sigma$	0..1	Reference(Encounter)	Encounter with which this imaging study is associated
 started	$\Sigma$	0..1	dateTime	When the study was started
 basedOn	$\Sigma$	0..*	Reference(CarePlan   ServiceRequest   Appointment   AppointmentResponse   Task)	Request fulfilled
 partOf	$\Sigma$	0..*	Reference(Procedure)	Part of referenced event
 referrer	$\Sigma$	0..1	Reference(Practitioner   PractitionerRole)	Referring physician
 endpoint	$\Sigma$	0..*	Reference(Endpoint)	Study access endpoint
 numberOfSeries	$\Sigma$	0..1	unsignedInt	Number of Study Related Series
 numberOfInstances	$\Sigma$	0..1	unsignedInt	Number of Study Related Instances
 procedure	$\Sigma$	0..*	CodeableReference(PlanDefinition   ActivityDefinition)	The performed procedure or code Binding: <a href="#">ImagingProcedureCode</a> <a href="#">(Preferred)</a>
 location	$\Sigma$	0..1	Reference(Location)	Where ImagingStudy occurred
 reason	$\Sigma$	0..*	CodeableReference(Condition   Observation   DiagnosticReport   DocumentReference)	Why the study was requested / performed Binding: <a href="#">Procedure Reason Codes (Example)</a>
 note	$\Sigma$	0..*	Annotation	User-defined comments

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note	Σ	0..*	Annotation	

## 10.5.4.2.1 WADO-RS

An `Endpoint.connectionType` of code `dicom-wado-rs`, system `http://terminology.hl7.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.

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"`,



# A brief overview of ImagingStudy

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partOf	Σ	0..*	Reference(Procedure)	
referrer	Σ	0..1	Reference(Practitioner   PractitionerRole)	
endpoint	Σ	0..*	Reference(Endpoint)	
numberOfSeries	Σ	0..1	unsignedInt	
numberOfInstances	Σ	0..1	unsignedInt	
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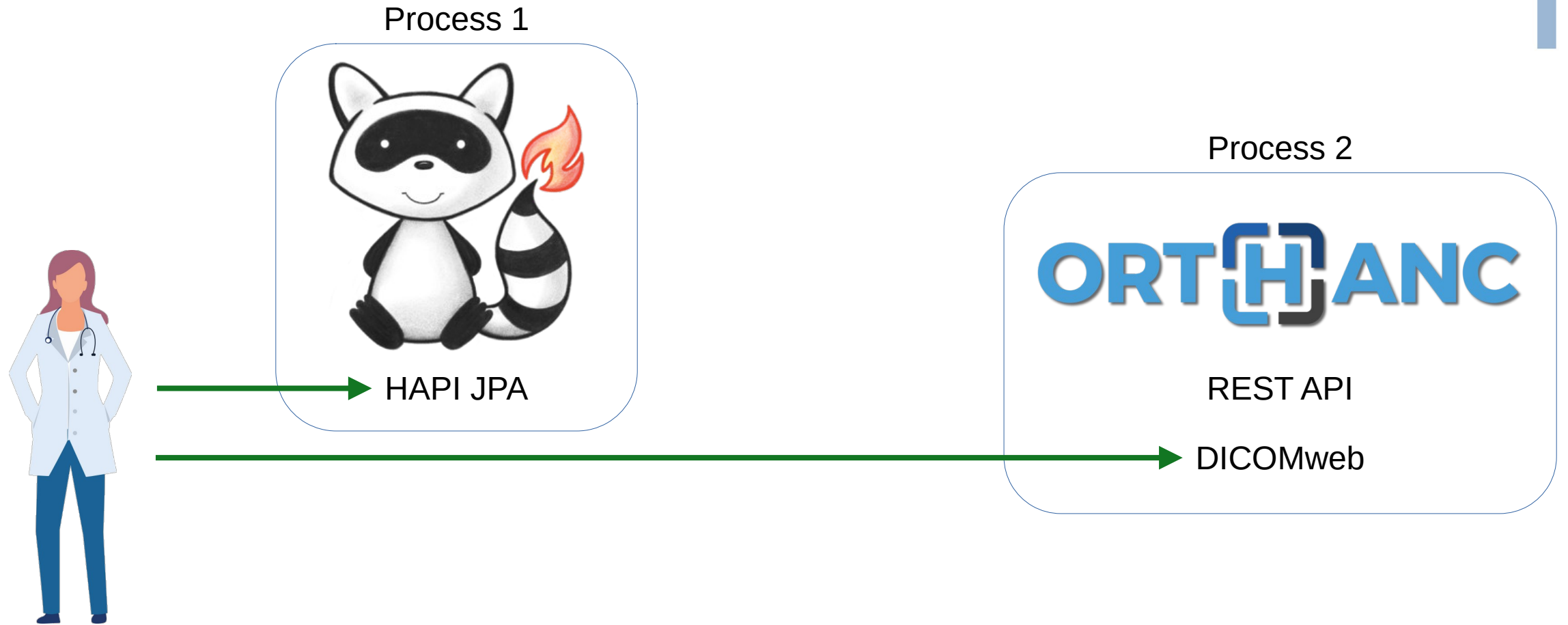


# Orthanc supports DICOMweb, but what about FHIR?

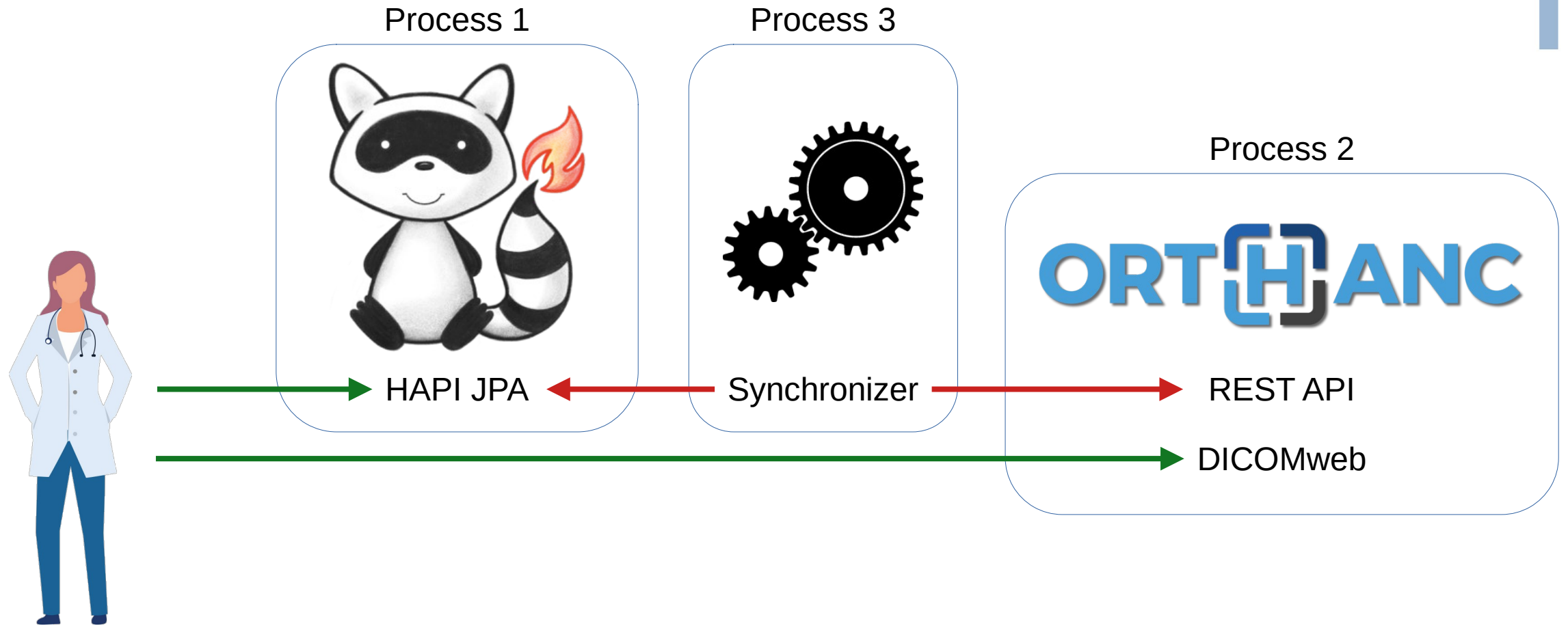


- HAPI provides the most up-to-date free and open-source **FHIR server**
- HAPI is written in **pure Java** (whereas Orthanc is written in C++)
- HAPI server exists in 2 versions: **Standalone (“JPA”)** or **library (“plain”)**

# Architecture 1: Continuous synchronization

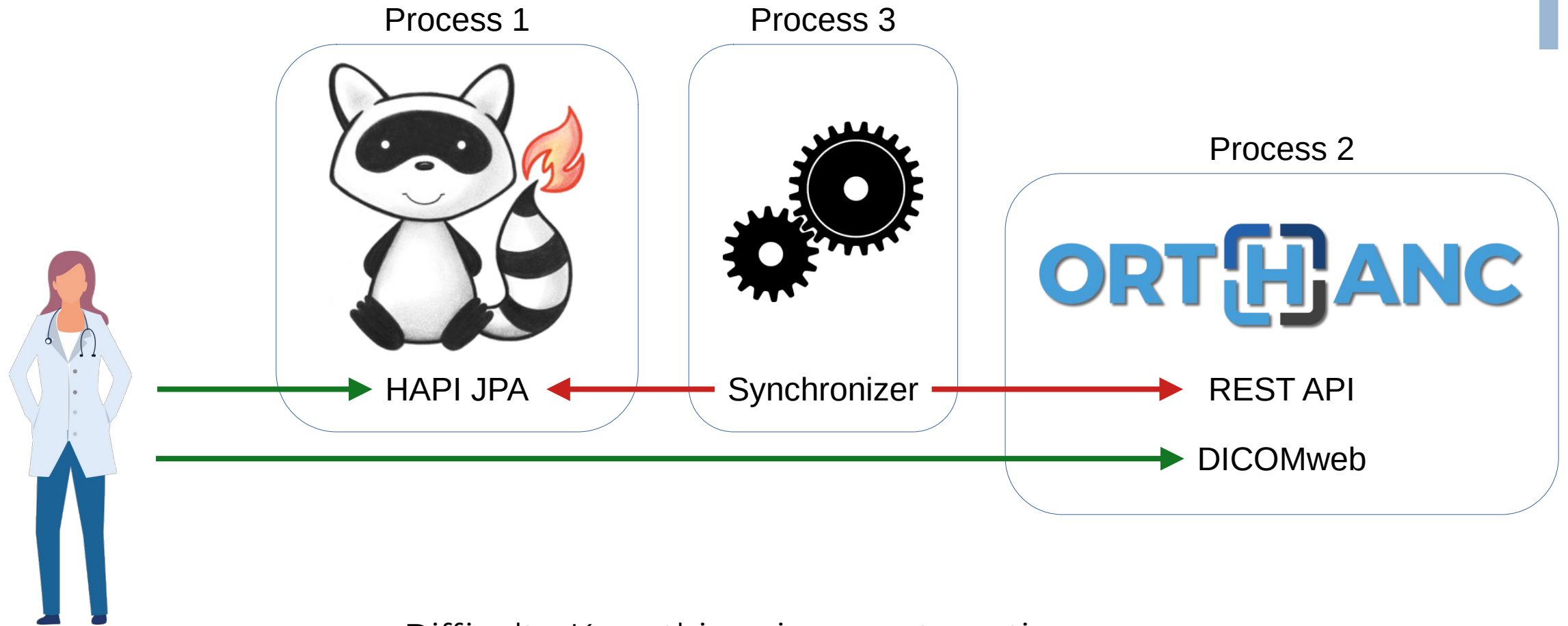


# Architecture 1: Continuous synchronization



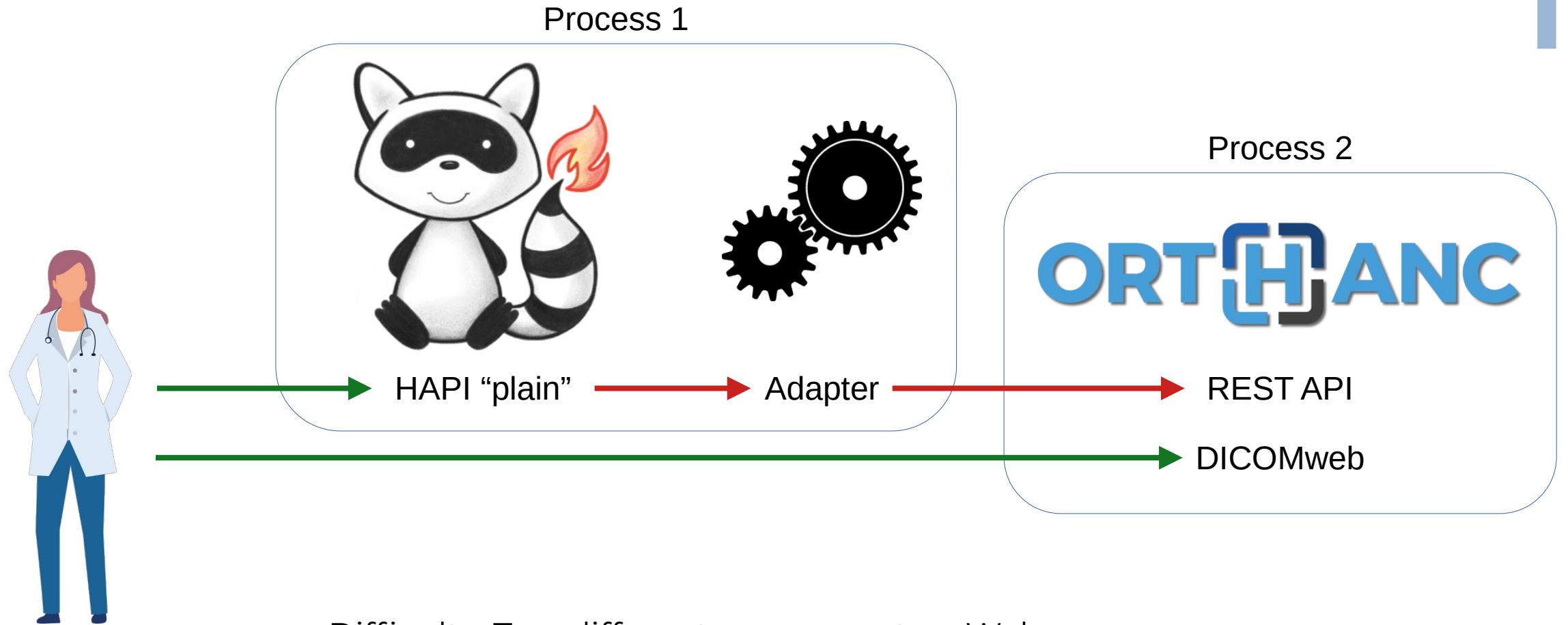


# Architecture 1: Continuous synchronization



Difficulty: Keep things in sync at any time

# Architecture 2: Use HAPI “plain” server



Difficulty: Two different processes, two Web servers  
(but globally acceptable if Docker Compose available)

# Architecture 3: Make HAPI a plugin to Orthanc

Process 1



ORT<sub>H</sub>ANC



→ /fhir route

→ DICOMweb

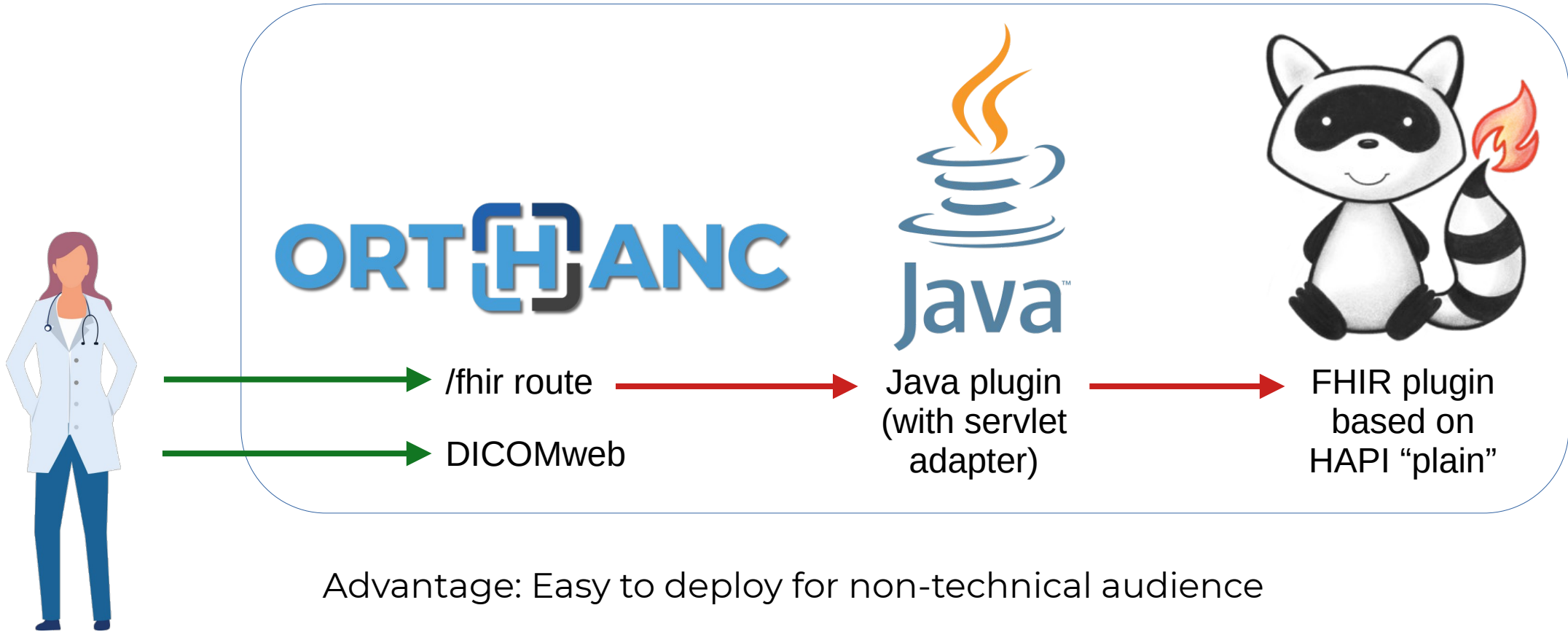
Advantage: Easy to deploy for non-technical audience





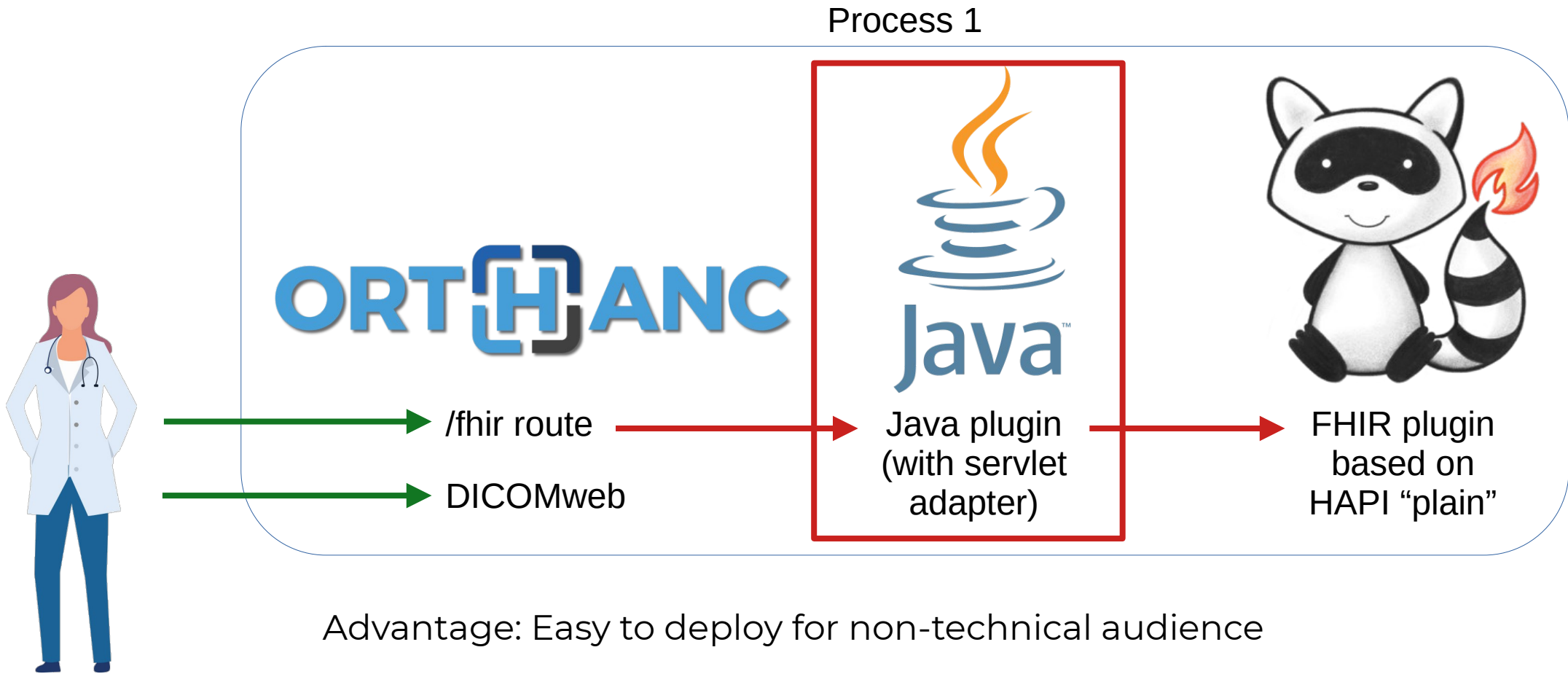
# Architecture 3: Make HAPI a plugin to Orthanc

Process 1



Advantage: Easy to deploy for non-technical audience

# Architecture 3: Make HAPI a plugin to Orthanc



**Java plugin is about to be released!**  
(similar to Python plugin)



UCLouvain