

# GUIDE Specifications

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# 1. Introduction

## 1 Purpose of the document

The aim of this document is to specify the application area of the VPH Toolkit component GUIDE: GUIDelines for Image Development Environments. This component is developed by actors of VPH – NOE from WP3 Imaging Tools subgroup 4: CREATIS–LRMN, INRIA and UPF.

This document is not intended to be a design document. Design and implementation are left to the GUIDE design documents.

## 2 Scope

This document only concerns GUIDE and data associated. It is not a reference document for VPH web portal.

## 3 Overview

This document describes the role of GUIDE and its features.

The first chapter explains GUIDE objectives and what needs will be filled.

The specification chapter is principally composed of three sections:

- ✓ First section presents items that should be available on GUIDE: definition and description of *items*, management of *items* and the display of items.
- ✓ Second section describes mechanisms that should be provided to find and determine relevant *items* for end-users.
- ✓ Third section contains extra features needed by GUIDE: connection to site with status, management feedbacks.

The last chapters describe error handling and risks associated with GUIDE.

## 2. GUIDE Objectives

In accordance with VPH WP3 general framework, the overall objective of GUIDE is to federate existing image analysis tools and to provide support enabling their sharing and open use.

Specifically, GUIDE will provide users with an online help for their choices of biomedical and medical imaging processing tools, as well in global cases (visualization tools for a medical image modality for example) as for more specific problems. The tools exposed by GUIDE should be software, libraries and/or scripts and development environment in function of end-users (software developers, researchers, clinicians or industrial users).

Because medical images analysis is very problem dependant, providing only a list of software tools is not sufficient to help the user. For example, segmentation in cardiac imaging is not the same problem as segmentation in brain imaging. This is the reason why GUIDE will also reference processing use cases and use them to drive the user in search for a tool.

In the following, we will refer to tools and use-cases as the “*items*” of GUIDE.

In this framework, the proposed overall structure of GUIDE is the following :

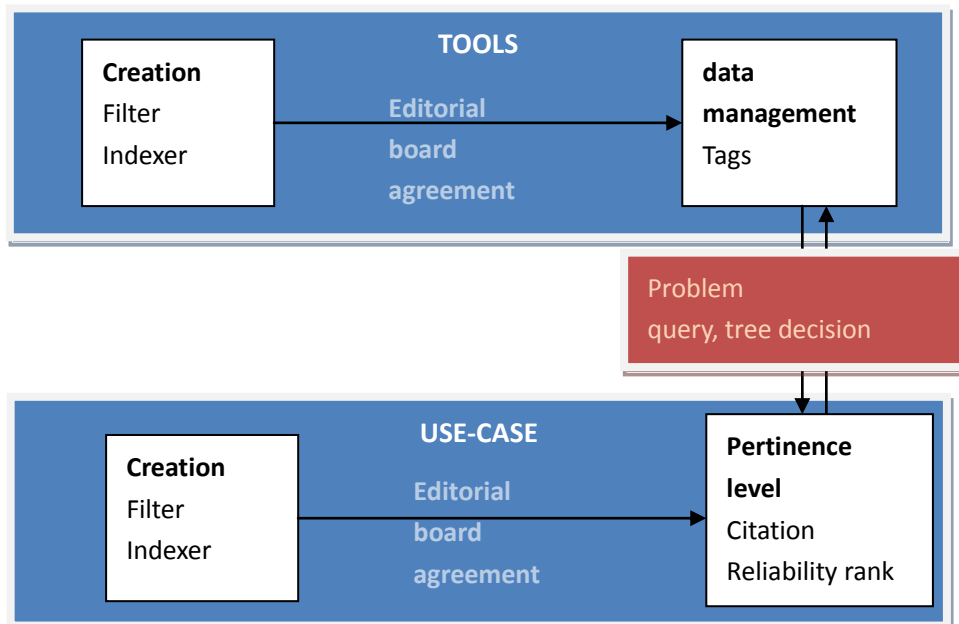


Figure 1 : GUIDE overview

Tools and use-cases, even if they will follow the same creation process, are two different entities. The problem is the link between tools and use-cases. In GUIDE

processing, the creation of tools (or use-cases) shall be strongly supervised by filtering parameters to avoid useless tools and have a pertinent indexation with a large generation of tags. Before being referenced and managed, an editorial board shall give his agreement. For use-cases, GUIDE should established levels of reliability from some fields (citation,...). Each problem submission in GUIDE, by query or by a decision tree, shall expose the relations between tools and use-cases. For this reason, one objective of GUIDE is to create a strong community around use-cases and associated discussions, a synergy between uses-cases authors and GUIDE users. Allowing comments or questions about use-cases will increase their pertinence and their application domain definition. Feeding use-cases will generate a pool of expertise and ensure GUIDE growing.

As a final remark, it should be noted that the success of GUIDE is linked to the following features:

- The set of *items* referenced by GUIDE should not be a closed list. It should therefore provide a mechanism allowing members of the VPH community (i.e. users and/or institutions) to feed in new tools/use cases;
- The referenced tools should be up to date: GUIDE should thus provide a mechanism for testing that a given tool is not obsolete and rely on active projects/communities.

## 3. Specifications

### 1. Global features

Each tool referenced by GUIDE shall be associated with several documents : technical documentations, screen captures, use cases, FAQ (Frequently Asked Questions), relative scientific articles, links to website and reference names (developers, investigator, ...).

The online technical documentation shall at least be linked and at most copied into GUIDE. The technical documentation should contain complete and detailed process for installation and reverse process, hardware and software limitations (OS type, library and/or environment requirements, ...), software architecture, how to run the software. GUIDE shall propose to add comments and feedbacks on each tool, to allow the knowledge base to grow.

GUIDE shall allow the possibility to add use cases from users for one or more specific tools.

All requests submitted to GUIDE shall have an answer. Any query (relative to an expertise domain) shall have one or more responses.

GUIDE shall propose an overview of its *items* (number, download statistics, connection, number of feedbacks, reliability ranks).

GUIDE shall allow anonymous connection to search and download a tool. But GUIDE

shall allow private connection to identify users who can add *items* to the knowledge database.

## 2. GUIDE proposed items

### 1. Tools definition

Different types of tools shall be referenced by GUIDE: software, library, online application for medical images processing with a version number (very important to provide some history and show evolution of tools). The application domains of tools shall be the same as defined by VPH framework. Tools shall provide at least one use-case.

### 2. Data attached to tools and use cases

The fields associated to the tools are listed in the table below.

FIELDS	EXPLANATION	MANDATORY	TYPE	MULTIPLE ENTRY
<b>Tool information</b>				
<b>Name</b>	Application Name	x	textbox	
<b>Speciality</b>	Competence domain	x	list	x
<b>Imaging modalities</b>		x	list	x
<b>Input – Output Data</b>		x	list	x
<b>Function</b>	Action(s) performed by the tool		list	x
<b>Version</b>	Production version		textbox	
<b>Tool specification</b>				
<b>Language</b>	Native Language, compiler version	x	list	x
<b>OS</b>	Platform to run tool	x	list	x
<b>Installation recommendation</b>	How to install with necessary library and software.	x	textbox	
<b>Type of the tool</b>	Describe the type of the tool	x	list	
<b>Licence</b>	What kind of licence? Open-source type (GNU GPL, CeCILL- B) or proprietary software	x	list	
<b>Tool documentation</b>				
<b>Short purpose</b>	Some text to quickly	x	textbox	

	explain the tool aim, a summary			
<b>Keywords</b>	Set of keywords to summarize tool		textbox	x
<b>Citation</b>	Links to webpages		textbox	x
<b>Reference papers</b>	If tool comes from an academic work, some reference to help for its description and behavior		textbox	x
<b>Snapshot</b>	Few snapshot to explain tool in action	x	textbox	x
<b>Use-cases</b>		x	textbox	x
<b>FAQ</b>	Frequently Asked Questions		textbox	x
<b>Long purpose</b>	A long paper or document to explain tool behavior and actions.		textbox	
<b>Download link</b>	One or more link to download tool	x	textbox	x

**Table 1: informations attached to a tool**

The fields associated to the use cases are listed in the table below.

FIELDS	EXPLANATION	MANDATORY	TYPE	MULTIPLE ENTRY
<b>Use-Case Information</b>				
<b>Name</b>	Use case Name	x	textbox	
<b>Tools</b>	List of tools available or not in GUIDE used to create this use-case	x	list textbox	x
<b>Tree addition</b>	Problems tree		list textbox	x
<b>Use-case documentation</b>				
<b>Data</b>	Data to reproduce the use-case		textbox	x
<b>Short purpose</b>	Text to quickly explain use-case aim, a summary	x	textbox	
<b>Keywords</b>	Set of keywords to summarize use-case		textbox	x
<b>Citation</b>	Links to webpages		textbox	x

<b>Reference papers</b>	If use-case arises from an academic work, some reference to help for its description		textbox	x
<b>Snapshot</b>	Few snapshot to explain use-case	x	textbox	x
<b>FAQ</b>	Frequently Asked Questions		textbox	x
<b>Long purpose</b>	A long paper or document to explain use-case.		textbox	

**Table 3-2 : informations attached to a use-case**

The application domain fields are shared by use-cases and tools, they are listed on table below:

FIELDS	EXPLANATION	MANDATORY	TYPE	MULTIPLE ENTRY
<b>Application Domain</b>				
<b>Author(s)</b>	A development team, an industrial team	x	textbox	
<b>How many people involved</b>	A single person, team, ...	x	list	
<b>Type of collaboration</b>	A single unit,an european project, ...		list	
<b>For who</b>	What kind of end-users		list	x
<b>webpage</b>	Team site,....		textbox	
<b>User Identification</b>	Only knew members shall propose an <i>item</i>		textbox	

**Table 3-3 : informations for application domain**

This set of fields shall be asked for each new *item* proposal. If some necessary criteria is missing, a warning shall alert and help user to fill missing informations. No *item* shall be indexed if missing necessary criteria remains .

Keywords are not necessarily provided by the user. Automatical keywords shall be generated and added. The keywords are extracted from the other fields : imaging modality, performed actions, speciality, short purpose...

If a use-case is submitted, the list of tools used in this use-case shall be entered. The list may contain referenced or unreferenced tools in GUIDE.

The lists of values for different fields are given in section 7 (Tools tables).

### 3. Items submission (reviewing)

Users should propose *items* through a form containing a questionnaire associated to the required informations (cf. table 1). The form should act as:

- ✓ a filter: if some criteria are not present, *items* will be not reviewed and indexed.
- ✓ a parser : extract automatical keywords.

After entering a new *item*, an editorial board will agree or not about this *item*. Before evaluation, the *item* shall have the status: "VPH approval pending". After evaluation, *item* shall be removed if editorial board decide or shall get the status: "VPH approved".

A rejection notice shall be given to the user who submitted the *item* with a clear and short explanation.

### 4. Tools display

A tool shall be displayed on two canvases: a small one with basic, synthetic information and a detailed one with all available information. The small canvas shall be displayed when a query is done. The detailed canvas shall be displayed when a selection is done.

Some fields (name, last modification, OS, type, snapshot, reliability rank, imaging modalities, use case) shall be present in short display.

GUIDE should display a tool even if it is not reviewed yet. But no reliability rank and feedbacks should be available. Moreover, the current VPH status (i.e. "VPH Approval pending") shall be displayed in front of tool to inform (warn) users.

### 5. Use-cases display

Use-cases shall be a special case of display because use-cases shall reference different tools with links to them.

For use-cases, identified users (as defined in 4.1) shall have the possibility to start one or more discussion about it. The discussion shall be accessible for all but only identified users can add comments on it, to avoid spams or no relevant remarks. The discussion shall be automatically directed to the author of a use-case. A discussion will be not size-limited as feedbacks will be. The discussions will be organized in a forum. Only short preview of discussion will be displayed on use-cases pages.

### 6. How to manage different version of a tool

Different possibility :

- ✓ add as a new tool
- ✓ Change version number and other fields : add in an additional database old

fields – values. By this way, when user select a tool, he could browse version/date to see older fields. This would be the ideal solution but the attached documentation will be difficult to reliably track in practice.

- ✓ Write on previous values and only add new version/date.

### 3. Query Features

To have access to *items* provided by VPH-NOE, GUIDE shall propose different types of query. Each query type shall respond to a specific task.

The basic types proposed by GUIDE shall be: a simple query and multiple query.

More advanced queries could be developed as decision tree-based and/or sentence analysis-based query. This could be part of the future version of GUIDE. Their complete specification could be given in a specific document.

The result of a query shall be displayed as two distinct sets: one set for tools and one set for use-cases.

A date field shall be provided for all query types. In GUIDE, users shall have the possibility to select a tool before or after a specific date.

#### 1. Simple – multiple query

A query should take two forms: selection in lists of *items* or entering in a textbox some keywords. The query shall only be performed after some validation action from the user.

GUIDE shall propose lists of fields to select one or many imaging *items*. The lists will perform a search for specific fields. When using a textbox, the search will be done on all fields in the database.

The list of fields provided by GUIDE to perform a search shall be:

FIELDS	MULTIPLE SELECTION
Speciality	X
Imaging modalities	X
Input Format	X
Output Format	X
Function	X
OS	X
Type of tools	X

**Table 4** : search fields

A user should be able to perform a search with only one field or with any combination.

A multiple query shall only be a combination of simple queries. Users shall have the possibility to apply a new query to the result of a previous one to refine results.

Some simple operators (AND and OR) could be added via textbox to refine or broaden search.

## 2. Decision tree

GUIDE could include a search tool using a decision tree.

A decision tree (or tree diagram) is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences. Decision trees are commonly used in decision analysis to help identify a strategy most likely to reach a goal.

A decision tree is a predictive model; that is, a mapping from observations about an item to conclusions about its target value. In these tree structures, leaves represent classifications and branches represent conjunctions of features that lead to those classifications.

The complete specification (creation and growing of the tree) would be done in a future document if this type of search tool is retained.

## 3. Sentence analysis - Problem analysis

This would be an advanced GUIDE feature for searching *items*. User could have the possibility through a textbox to perform a search on available imaging tools and use-cases by sending a sentence. By entering a sentence, a user has the possibility to clearly describe his medical images analysis problem. The specification of this feature would be done in a future document if this type of search tool is retained.

## 4. Querying options

GUIDE should have options on queries. These options are advanced features, too.

- ✓ GUIDE could add rules to match results. By default, only results who match exactly the query (simple or multiple) shall be displayed. GUIDE should provide, in an extended version, a way to display *items* related to the initial query. For example, if user enters the “registration” keyword, a more flexible search should include related topics such as “segmentation” or “fusion”. The complete specification of extended matching would be done in a future document if the type of search tool is retained.
- ✓ A query could include some searches on the internet. For each online items, if some links are available (from Wikipedia, from pub med, ...) in GUIDE database, an API should allow a query on these links. The specification of this feature would be done in a future document if the type of search tool is retained.

## 4. Online Items

### 1. Users, identification and roles

Guide shall allow three kinds of users with three different permissions / roles:

- ✓ Anonymous users shall have a "read-only" access which allows searching and downloading available *items* on GUIDE - VPH NOE portal.
- ✓ Identified users will be able to submit new tools to GUIDE database, to add feedbacks on *items*. To get an account, the user shall provide the following informations:

FIELD	MANDATORY
<b>name</b>	X
<b>valid email</b>	X
<b>phone number</b>	
<b>institution</b>	
<b>nickname</b>	X
<b>password</b>	X

**Table 3-5 : user registration**

- ✓ Authorized users: the third role would be granted to the members of the editorial board and would include with tools and use-cases management rights as well as pending submissions acceptance / rejection rights.

### 2. Feedbacks, reliability rank

GUIDE shall provide two systems to annotate available online tools: feedbacks and reliability ranks.

#### *Feedbacks:*

Feedbacks and adding comments shall be only allowed for identified users. Removing feedbacks shall be done only by authorized users.

Feedbacks on GUIDE should have two functions:

- ✓ Comment, specify (either positively as negatively) functions of a tool, mention some problems linked to a tool and report successful/unsuccessful use of a tool.
- ✓ Explains an "analyze" with the tool. Such feedbacks should be promoted as use-case.

Feedback on feedbacks should be allowed, up to certain level by identified users.

#### *Reliability ranks:*

Ranks shall be used to define the popularity of a tool. In GUIDE, two ranks shall be present: the first one to represent the download number (the more a tool is downloaded, the higher the rank is), the second one is computed using grades given by indentified users. The zero grade shall have a comment to explain this value and be sent to moderators to prevent errors.

For use-cases, a reliability rank computed as for tools should be available.

### **3. Management**

GUIDE shall be a living tool. The available informations in GUIDE shall periodically be tested to ensure that they are still valid and they do not need to be updated.

A backup database shall be provided to ensure that no data is lost.

The author of an original submission should have the possibility to add or update the information he has provided without a new review.

An associated mailing system should be configurable to automatically send information on newly added tools or features to the users who have selected this option.

### **4. Front page**

On the front page, GUIDE shall provide an overview of its available tools, use-cases and hit statistics.

For tools, GUIDE shall give the number of: recorded tools, downloads via GUIDE, connections, feedbacks. GUIDE shall provide a list of top reliable, downloaded, and consulted, etc. tools.

For use cases, GUIDE shall give their number, the percent or number of GUIDE tools associated with them and their reliability ranks.

GUIDE shall have a disclaimer to avoid misguidances on tools and use-cases.

### **5. Forum**

GUIDE may have a moderated forum to permit users comments and questions. **This is an open issue, to be considered in with the VPH Portal configuration.**

## **4. Error Handling**

Any unexpected event shall be written in a log file for tracability. A default page shall be used as a warning for users.

We will focus here on the error handling of GUIDE specific features :

1. Search : If a query returns no result, a warning message shall inform user to modify query parameters to enlarge the search.
2. Missing page: if a page is missing in GUIDE, the front page shall be displayed instead.
3. Broken link : if a link is not available anymore, an specific icon shall warn user.

## 5. Risks

GUIDE entails three major risks : complete removal of available online *items*, misguidance on analysis and death of GUIDE due to a non-sufficient activity.

To prevent a complete remove, at each new addition a complete back-up of GUIDE shall be done.

GUIDE will not be responsible for the use of tools. A disclaimer shall be published. GUIDE only proposes tools and use-cases. To avoid misguidance, a strong knowledge database is necessary. The more use-cases get included, the more GUIDE will be pertinent and risks of misguidance will decrease.

Natural death could occur if no input (use-cases or tools) is provided to GUIDE. To have a living site, the presence of a strong community is necessary. To ensure that, GUIDE should provide, from the beginning, a large panel of use-cases.

## 6. Verification and Validation Plan

A preliminary testing phase will be accomplished by performing a structured set of tests that use all objects and features of GUIDE. A second phase of verification will be done with a survey of use-cases from VPH-NOE members. This phase will have two objectives : create a first use-case community as previously described and ensure that no feature is missing.

In first versions of GUIDE, no advanced feature will be present. Their specification and deployment will be done in the future.

## 7. Tools tables

These lists of values shall be the initial lists proposed by GUIDE. An identifier user shall have the possibility to add new values via *Other* item. The new value shall be submitted to the editorial board. **The lists are open to discussion.**

FIELD	VALUE	SUBVALUE
<b>Imaging modalities</b>	IRM	Tagging FMRI Constrat MRI
	TEP CT MEG fIRM IRM SPECT Ultrasound Other	
<b>Organ/structure</b>	Bones Brain Cardiac Liver Muscles Pulmonar Other	
<b>Pathology/Function</b>	Neurology Oncology Radiology None Other	
<b>Input- Output data Format</b>	DICOM Jpeg Tif Text file Other	
<b>Function</b>	Filtering Smoothing Extraction Segmentation ROI Quantification Modeling	

	Simulation Statistics Registration PACS Convert Display Other	
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Table 6: fields list for tool description

FIELD	VALUE
Language	C++, Java, python, PHP
OS	All Windows Mac Unix Linux
Licence	All CeCILL CeCILL-B GNU GPL Modified BSD LPGPL Proprietary software Other
Type of tool	All Script Executable Code API - library Combination of tools Use - case

Table 7: fields list for tool installation

FIELD	VALUE
How many people involved	1, 1-10, 10-100, More...
Type of collaboration	Single team,

	an european project, Other
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**Table 8: fields list for application domain**