

HITCH

Interoperability Test Tools – State of the Art and Future –

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2- Agenda

- ▶ **Introduction**
- ▶ **Survey of test tools available today (“Today”)**
 - ▶ Tool landscape
 - ▶ Observations
- ▶ **Needs for future tools (“Tomorrow”)**
 - ▶ Vision
 - ▶ Gaps
- ▶ **Conclusions**

3- Introduction: Interoperability

- ▶ Health IT systems need to exchange and process patient-related information
 - ▶ within a department or institution
 - ▶ beyond departmental, institutional or even national borders
- ▶ Interoperability: the ability to exchange and understand communicated information between systems.
 - ▶ a prerequisite for a working eHealth infrastructure
 - ▶ only established to a limited degree today
- ▶ Reasons for interoperability problems: lack of standards, ambiguous standards, incorrect interpretation of standards.
- ▶ This can be prevented to some degree by adequate interoperability testing of systems before deployment.

4- Introduction: Test Tools

- ▶ Test tools: an important factor in conformance and interoperability testing.
 - ▶ Think of an IHE Connectathon without MESA & Gazelle...
- ▶ Many tools available, but no adequate overview
 - ▶ Are there test tools for all relevant protocols and content formats?
 - ▶ Are the tools sufficiently stable and well-maintained?
 - ▶ Can the tools be integrated into a testing infrastructure?
 - ▶ What's missing today?
- ▶ HITCH developed a survey of test tools to identify needs for future tools that allow for better conformance & interoperability testing

5- Scope of the Test Tool Survey

- ▶ Look at the “big picture” beyond tool functionality:
 - ▶ Vitality: Maintenance, release frequency, user community...
 - ▶ Maturity: “Quis custodiet ipsos custodes?”
- ▶ Consider integration into test management infrastructure
 - ▶ Open source tools (license is important!)
 - ▶ Open source test scripts with (partly) closed interpreters (TTCN3)
 - ▶ Closed source tools with open API
- ▶ Exhaustive survey turned out to be infeasible:
 - ▶ Health IT standards like DICOM, HL7 quite complex
 - ▶ Health IT also uses “generic” IT standards like SOAP, TLS, ebXML...
 - ▶ *Therefore, survey focuses on most important tools (not perfect, but better than what we had before...)*

6- Survey Criteria

- ▶ General
 - ▶ Tool name, description, author, version, license, programming language
- ▶ Websites
 - ▶ Homepage, documentation, source code repository, bug tracker...
- ▶ Similar projects
- ▶ Tool category
 - ▶ Validator: checks the behavior of the tested communication partner
 - ▶ Sniffer: records, decodes and analyzes network traffic
 - ▶ Simulator: connection partner for testing peer's communication behavior
 - ▶ Library: implementation of standard that can be used to build test tools
 - ▶ Test Management Tool: manages test scenarios for peer-to-peer tests
- ▶ *Out of scope: tools for performance tests, load tests, security tests.*

7- Tools Evaluated (1/3)

Name of Tool	Type of Tool	Application Domain
AHML Message Testing	Validator	HL7
CDA Validation NIST	Validators	IT
chiba	Library	IT
dcm4chee	Library	DICOM
DCMTK	Library	DICOM
DICOM Router	Tool	DICOM
dicom3tools	Library/Tools	DICOM
dicom4j	Library	DICOM
DVTk	Validator / Simulator	DICOM
ejbca	Library	Other
Wireshark	Validator	Other
Gazelle	Tool	Other
GDCM	Library	DICOM
GDCM Conformance Tests	Testdata	DICOM
gnutls	Validator	Other
HAPI	Library	HL7
HL7 Message Maker	Tool (incl. Validator)	HL7
HL7 Insight	Tool	HL7
HL7 Inspector	Tool	HL7
HL7 Validation Nist	Validator	HL7

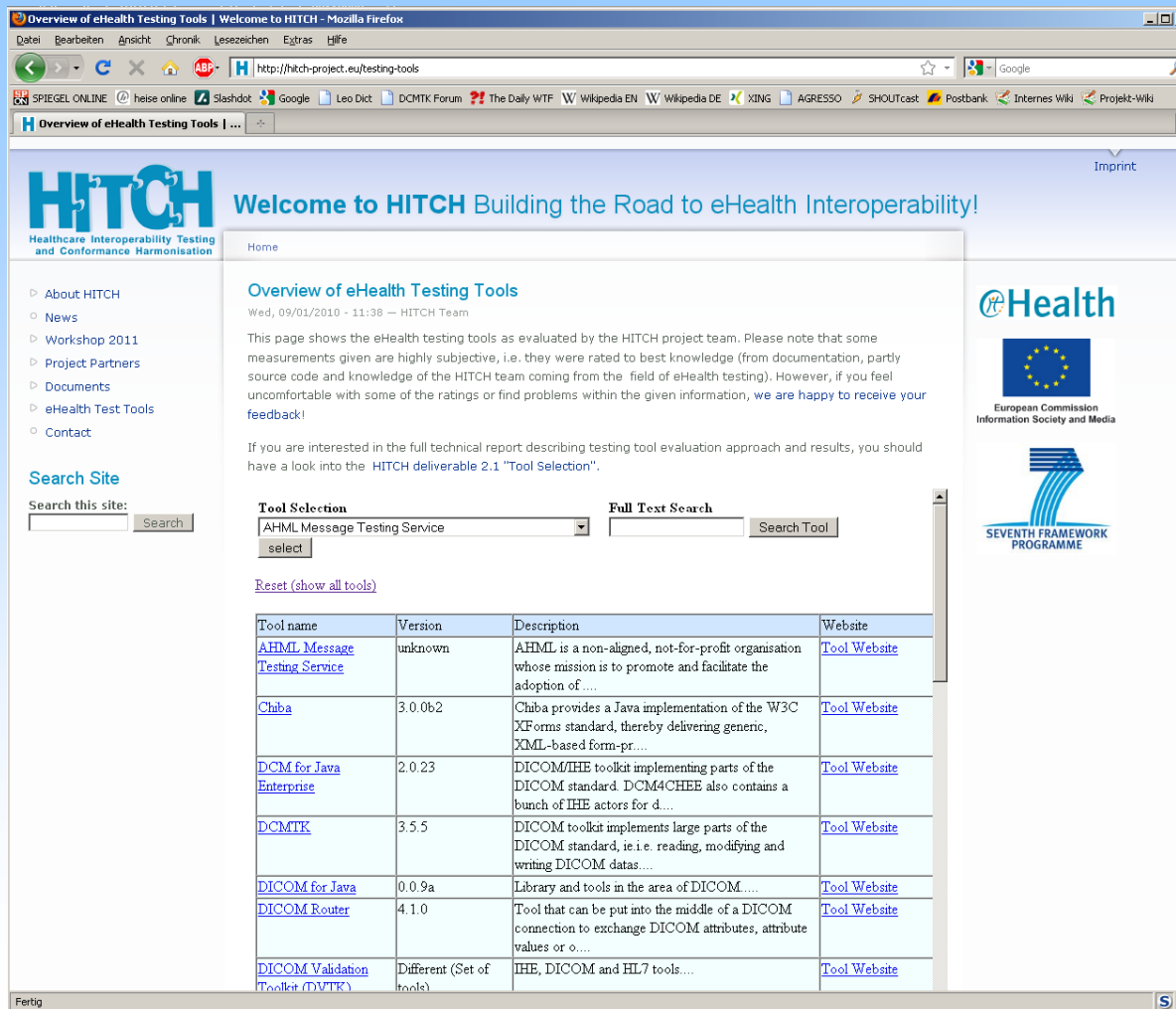
8- Tools Evaluated (2/3)

Name of Tool	Type of Tool	Application Domain
Iheos	Library	IT
MESA	Validator / Simulator / Reference Implementation	HL7/DICOM/IT
Microsoft Connected Health Platform Solution Accelerator	Library/Tools	IT
MirthConnect	Tool (Message Broker)	HL7/DICOM/IT
MWB	HL7	HL7
Nule.org: HCM (HL7 Comm Multi)	Tool	HL7
Nule.org: HL7 Anon	Tool	HL7
Nule.org: HL7 Browser	Tool	HL7
Nule.org: HL7 Diff	Tool	HL7
Nule.org: HL7 Comm	Tool	HL7
Nule.org ::HL7 Snip	Tool	HL7
OHT :: mdht	Library + Validator	HL7
OHT :: Open Health Workbench	Library + Validator	HL7
Open eHealth Foundation	Implementations	HL7/IT

9- Tools Evaluated (3/3)

Name of Tool	Type of Tool	Application Domain
Openca	Library	Other
OpenHealthTools	Implementations	HL7/IT
pixelmed	Library/Tools	DICOM
SOAPUI	Simulator / Validation	Other
TestLink	Tool	Other
The Eurorec Use Tools	Tool	Other
TTCN3	Tool	HL7
Web Services Validation Tool for WSDL and SOAP	Validator	Other

10- Results Database at <http://hitch-project.eu/testing-tools>



HITCH Healthcare Interoperability Testing and Conformance Harmonisation

Welcome to HITCH Building the Road to eHealth Interoperability!

Home

Overview of eHealth Testing Tools
Wed, 09/01/2010 - 11:38 — HITCH Team

This page shows the eHealth testing tools as evaluated by the HITCH project team. Please note that some measurements given are highly subjective, i.e. they were rated to best knowledge (from documentation, partly source code and knowledge of the HITCH team coming from the field of eHealth testing). However, if you feel uncomfortable with some of the ratings or find problems within the given information, we are happy to receive your feedback!

If you are interested in the full technical report describing testing tool evaluation approach and results, you should have a look into the HITCH deliverable 2.1 "Tool Selection".

Tool Selection **Full Text Search**

[Reset \(show all tools\)](#)

Tool name	Version	Description	Website
AHML Message Testing Service	unknown	AHML is a non-aligned, not-for-profit organisation whose mission is to promote and facilitate the adoption of ...	Tool Website
Chiba	3.0.0b2	Chiba provides a Java implementation of the W3C XForms standard, thereby delivering generic, XML-based form-pr...	Tool Website
DCM for Java Enterprise	2.0.23	DICOM/IHE toolkit implementing parts of the DICOM standard. DCM4CHEE also contains a bunch of IHE actors for d...	Tool Website
DCMTK	3.5.5	DICOM toolkit implements large parts of the DICOM standard, i.e. reading, modifying and writing DICOM datas...	Tool Website
DICOM for Java	0.0.9a	Library and tools in the area of DICOM....	Tool Website
DICOM Router	4.1.0	Tool that can be put into the middle of a DICOM connection to exchange DICOM attributes, attribute values or o...	Tool Website
DICOM Validation Toolkit (DVTK)	Different (Set of tools)	IHE, DICOM and HL7 tools...	Tool Website

11- Results Database: Example

Properties of tool soapUI

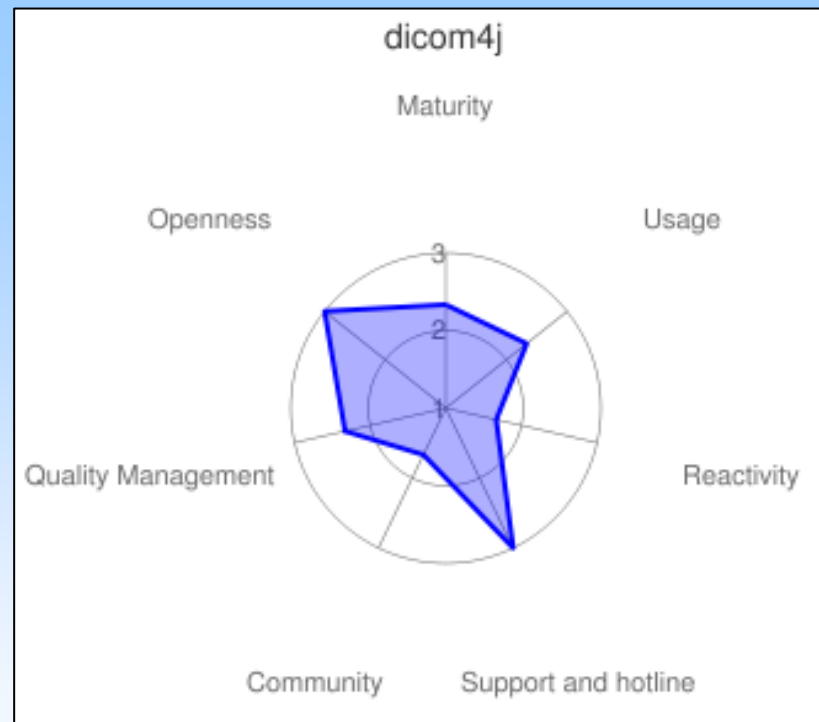
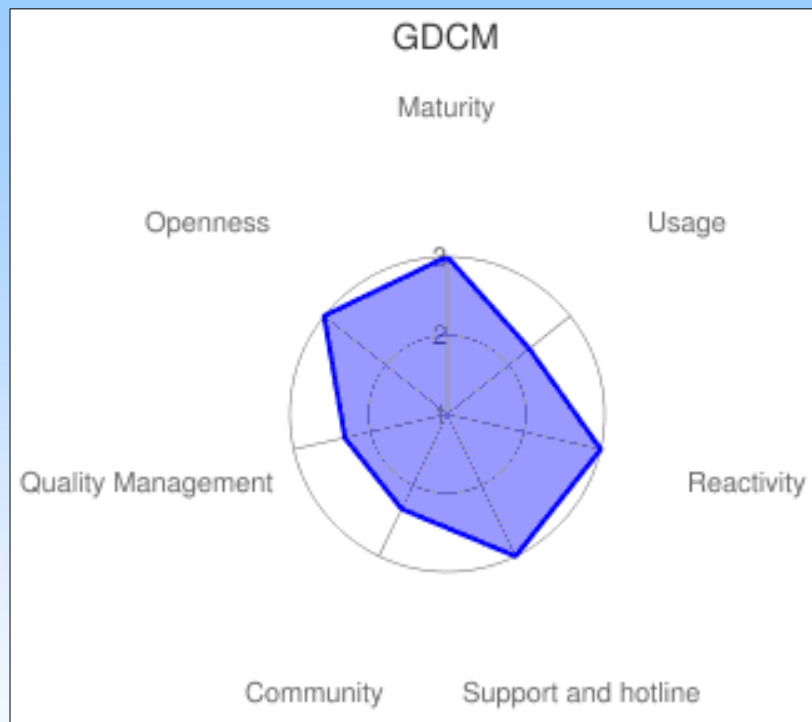
[Back to Tool Selection...](#)

Tool Name	soapUI
Version	3.6
Author	eviware
Category	Test Management, Validator
Website	http://www.soapui.org
Description	soapUI is more than SOAP testing. Over time it has become a Swiss army knife for functional testing and has support for many tests areas. Generally speaking, the main feature sets of soapUI are Service Simulation, Functional Testing and Load Testing. soapUI also includes many features for increased Test Quality as well as support for multiple protocols and several standards.
Wiki	No
Source Code Management	No
Documentation	http://www.soapui.org
Bug tracking	
Similar Tools	Wsvt (IBM)
Downloads	
Installations	
License	GNU Library or Lesser General Public License (LGPL)

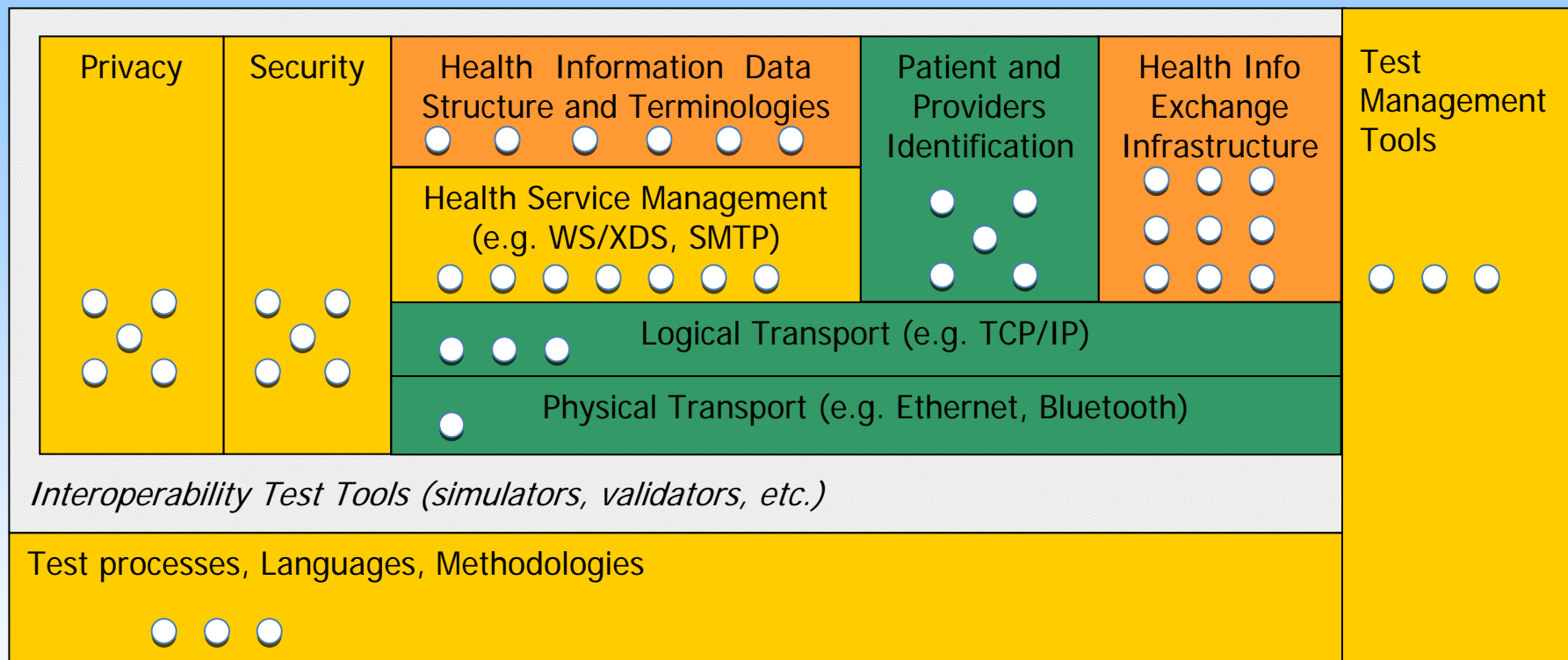
12- Survey Criteria: Radar Plot Categories

- ▶ The “soft factors” besides tool functionality were assessed in 7 categories
 - ▶ *Development status (“maturity”)*: in development, beta, in production
 - ▶ *Usage*: no / few / many users or project use the tool
 - ▶ *Reactivity*: how fast do the developers react e.g. to bug reports
 - ▶ *Support*: means of user support (forum, mailing list, hotline...)
 - ▶ *Community*: size of community maintaining the tool
 - ▶ *Quality Management*: use of QM tools by the developers
 - ▶ *Openness*: open source status, license
- ▶ Rating: 1=weak, 2=intermediate, 3=strong
- ▶ Subjective rating by expert consensus

13- Radar Plots (Examples)

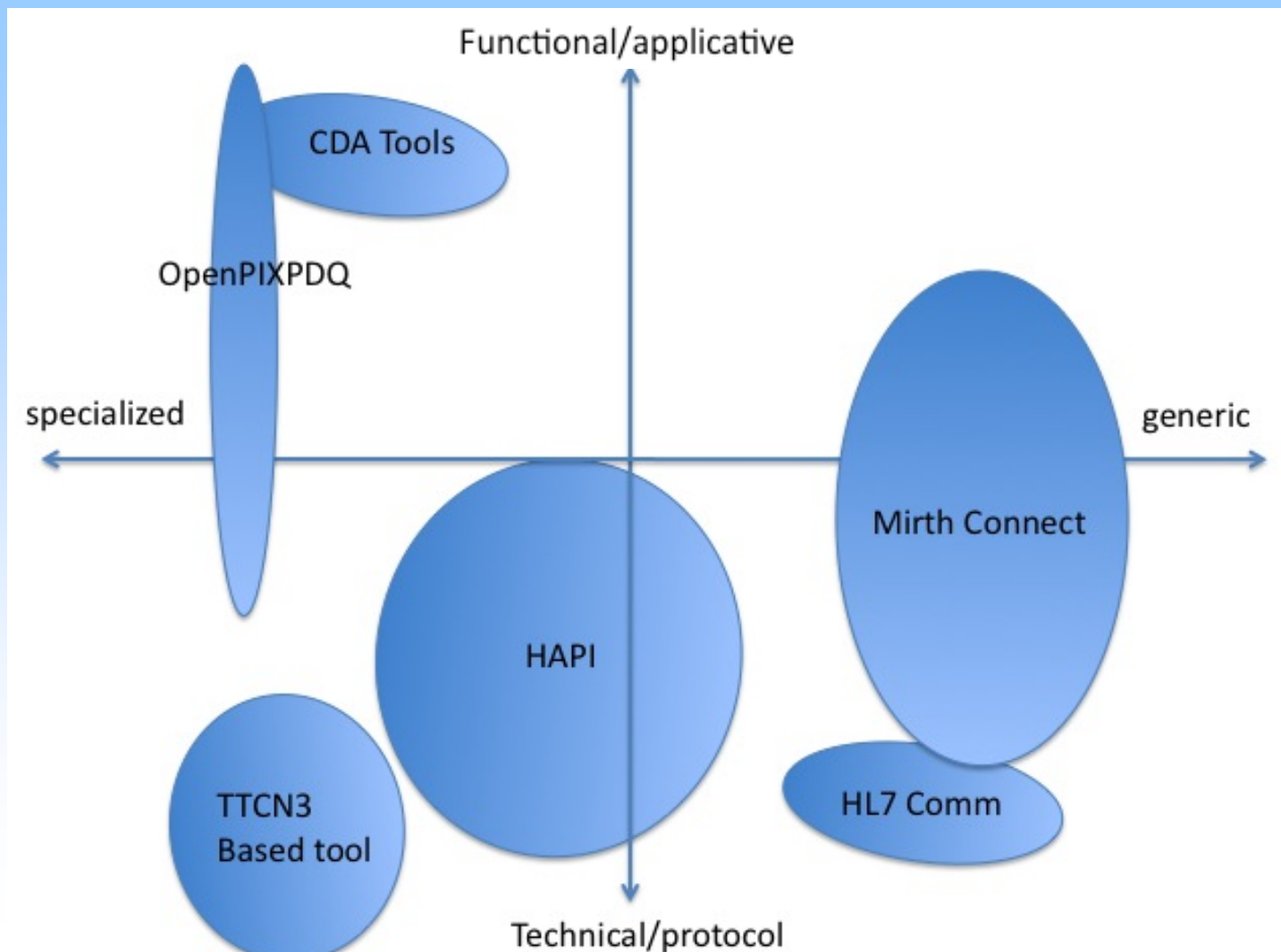


14- Test Tool Survey: Landscape



► Green=mature, orange=intermediate, yellow=immature

15- Test Tool Domain Map: HL7



16- Test Tool Survey: Observations 1

- ▶ The more mature a standard or and specification is, the higher is the quality of test tools.
- ▶ As the maturity of a tool increases, so does QM (vice versa?)
- ▶ Some test tools are “turn-key solutions”, other are “toolboxes”
 - ▶ Generic toolboxes may require significant configuration / scripting
 - ▶ Turn-key solutions may not be possible for rather generic standards
- ▶ Tool support for the following domains is weak so far:
 - ▶ Test management tools (IHE Gazelle, EuroRec UseTools)
 - ▶ Tools for processes and methodologies
 - ▶ Tools for health information exchange infrastructure
- ▶ TTCN3 a future basis for eHealth test management?
 - ▶ ETSI proof-of-concept during the 2010 Connectathon.

17- Test Tool Survey: Observations 2

- ▶ When standards are only available for a fee, implementers tend to use public “final draft” → bad for interoperability.
 - ▶ Free availability of standards is preferable (e.g. DICOM, IHE)
- ▶ Interfaces are not an innovative aspect where vendors need to differentiate their products from each other.
 - ▶ Common implementations (toolkits) make life easier for everyone
 - ▶ Common test tools make life easier for everyone
- ▶ Complex & evolving standards require complex & evolving test tools.
 - ▶ Testing tools require an ecosystem of developers, users and funding for their maintenance. This is a challenging task!

18- Strategic Vision

- ▶ What is needed to solve the interoperability challenge in the eHealth sector?
 - ▶ International agreement on common standards (or at least cross-references/mappings between standards)
 - ▶ Close cooperation between political mandates, SDOs, testing/auditing organizations and implementers.
 - ▶ Standard development always accompanied by test tool development.
 - ▶ Regular testing events like IHE Connectathon.
 - ▶ Quality labeling/certification programs that include system testing.
 - ▶ Alignment of functional auditing and technical interoperability testing, based on realistic & commonly agreed use cases.
 - ▶ A testing tools ecosystem

19- Technical Vision: Tool Development

▶ Test Plan Definition

- ▶ We need test management tools that support
 - ▶ The creation and organization of test criteria (functional statements and interoperability criteria).
 - ▶ Links between criteria and the underlying standards
 - ▶ The composition of test plans from those criteria.

▶ Test Design

- ▶ We need test design tools that combine functional requirements and interoperability criteria into a test case that can be assigned to a number of test partners and test tools (simulators, validators).
- ▶ The tools should be aware of the concepts to be tested (model aware) in order to guide the test designer

20- Technical Vision: Tool Development

- ▶ Test Tool Development and Selection
 - ▶ Develop those test tools still missing today (gap analysis)
 - ▶ Improve existing tools where needed
- ▶ Test Case and Test Tool Validation
 - ▶ Make sure test software works correctly and tests comprehensively, document in validation report
 - ▶ Maintain bug tracking tools for bugs in test cases and test tools
- ▶ Test Session Execution
 - ▶ Provide training material for auditors and testers
 - ▶ Integrate test tools with test management tool

21- Technical Vision: Tool Development

▶ Test Session Reporting

- ▶ Evaluation of the system under test: features tested, failed tests, list of non-conformities, 3rd party systems tested with
- ▶ Evaluation of the test session: number of tests performed / verified / failed / not verified
- ▶ Evaluation of the monitor work: was staffing sufficient?
- ▶ Evaluation of the testing quality:
 - ▶ Satisfaction questionnaire for participants and monitors
 - ▶ Report to the QA management in order to identify weaknesses and improvements for the next cycle.

22- Conclusion

- ▶ “Driver Projects” are important for implementing the vision of an interoperable eHealth ecosystem
 - ▶ epSOS defines typical eHealth use cases and provides technical specifications for tasks like ePrescription, eDispensation etc.
 - ▶ SEHGovIA proposes solutions for policy, legal & regulatory and governance issues in cross-border eHealth communication
- ▶ Few successful international initiatives in eHealth testing exist, namely IHE and EuroRec.
 - ▶ Approaches and concepts of these organisations need to be aligned.
- ▶ Test tools are only one building block for interoperability, but arguably among the most important.
 - ▶ Deserve more attention than they had in the past.