TESTING AND CERTIFICATION OF COMPONENTS FOR AMBIENT ASSISTED LIVING ECOSYSTEM

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1. Motivation

Developed societies are currently facing severe demographic changes: the world is getting older at an unprecedented rate [1]. This demographic trend will be also followed by an increase of people with physical limitations. New challenges will be raised to the traditional systems of health care. There is an urgent need to find solutions that allow extending the time people can live in their preferred environment by increasing their autonomy, self-confidence and mobility. Although some technologies for Ambient-Assisted Living (AAL) are already available and often in use as an answer to the needs stated above, these 'first offers' for primary and secondary end-users are monolithic, incompatible and thus expensive and potentially not sustainable.

The AAL4ALL project [2] aims at answering to those prob- lems through the development of an ecosystem of interopera- ble products and services for AAL, associated to a business model and validated through a large scale trial.

2. Goals

Included in AAL4ALL project arises this dissertation project that had the following main objectives:

- Define a methodology for testing and certification components of AAL;
- Development of infrastructure automation testing, supported the operationalization of the defined methodology;
- Applying the proposed methodology in a one or more pilot scenarios for the demonstration, validation and refinement of the methodology, in interaction with other project partners.

3. Proposed Methodology

Given the business model defined for the AAL4ALL project what follows the certification process shown in Fig. 1), a new methodology for testing and certification was developed.

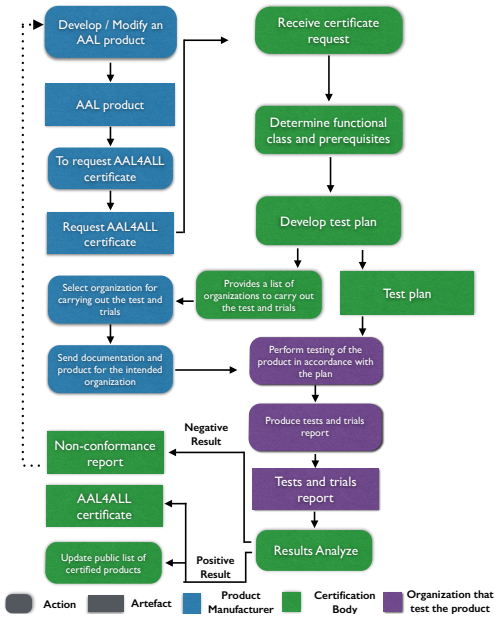


Fig. 1 – The AAL4ALL Certification Process

The proposed methodology is based on a process composed of three different verification steps:

- Checking the fulfillment of the standard component prerequisites via the analysis of appropriate evidences;
- Passing compliance test cases derived from the standard component specification, covering all the messages, effects, conditions and triggers;
- Passing interoperability test cases derived from the service integration scenarios in which the standard component participates (using certified components for the other participants), covering all the messages and branches.

The prerequisites are intended to ensure that the candidates components have evidence that are necessary to enter the ecosystem (e.g. CE labeling [3], compliance with ISO/IEEE 11073 standard [4]). The compliance test, aim to ensure that the candidate component communicates according to what is specified in the rules. Interoperability tests aim to demonstrate that the candidate component behaves as expected when integrated with other components. The compliance and

interoperability are described according to the IEEE Std 829^{TM}-2008 [5].

4. Application of Methodology

The proposed methodology been yet still subject to validation through as a pilot scenario (Fig. 2).

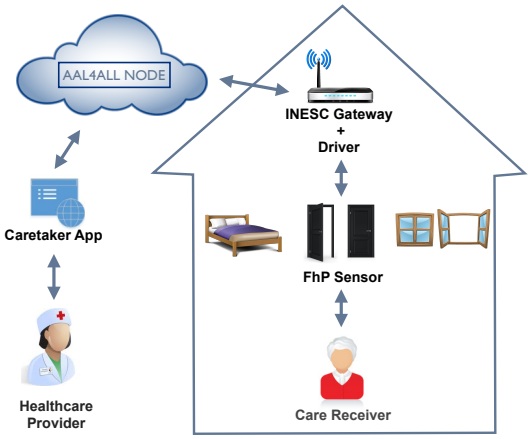


Fig. 2 – Representation of test scenario

This scenario was composed for components of AAL4ALL project, for which test cases were defined. Was also set up an automatic testing platform, for components that only have software interfaces (Fig. 3), which allowed not only automate some of these tests but also optimize the testing and certification process.

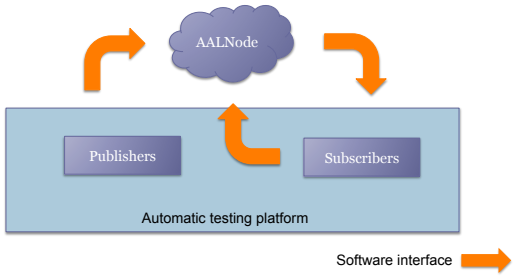
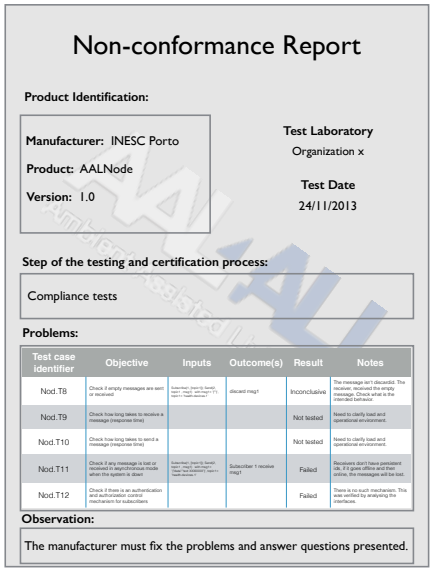


Fig. 3 – Representation of the Automatic testing platform for the AALNode

Since the components that componse the scenario are still at a very initial stage, it was not possible to certify any of the components, since they all had flaws particularly in steps of conformance testing.

The errors found in various stages of testing are reported, in the form of a non-conformance report (Fig. 4), for that manufacturers can fix them and re-submit the product to further testing.


Non-conformance Report

Product Identification:

Manufacturer: INESC Porto
Product: AALNode
Version: 1.0

Test Laboratory
Organization x

Test Date
24/11/2013

Step of the testing and certification process:

Compliance tests

Problems:

Test case identifier	Objective	Inputs	Outcome(s)	Result	Notes
Nod.T8	Check if empty messages are sent or received		discard msg1	Inconclusive	The message isn't discarded. The receiver, received the empty message. Check what is the intended behavior.
Nod.T9	Check how long takes to receive a message (response time)			Not tested	Need to clarify load and operational environment.
Nod.T10	Check how long takes to send a message (response time)			Not tested	Need to clarify load and operational environment.
Nod.T11	Check if any message is lost or received in asynchronous mode when the system is down		Subscriber 1 receive msg1	Failed	Receivers don't have persistent ids. If it goes offline and then online, the messages will be lost.
Nod.T12	Check if there is an authentication and authorization control mechanism for subscribers			Failed	There is no such mechanism. This was verified by analysing the interfaces.

Observation:

The manufacturer must fix the problems and answer questions presented.

Fig. 4 – Non-conformance report issued for the AALNode

5. Conclusions

All objectives initially proposed for this dissertation project were achieved. The proposed methodology proved to be able to identify problems not only compliance but also issues of interoperability, thus allowing ensure that components that achieve accreditation will be able to coexist in total harmony in an ecosystem.

Since it was not possible to have more products (or fully complete products) to create other test scenarios, useful in the future will try to test this methodology into new and more complete testing scenarios. In the future, will need to create categories of components, so that lists of prerequisites for applicants components can be constructed. Similarly after the creation of those categories will be possible to define a set of requirements that components must fulfill , so that the development of conformance test to be performed on these components are created with the objective of ensuring that components meet the requirements of the categories of quals are applying.

During this dissertation project was still produced a scientific paper entitled “A Testing and Certification Methodology for an Ambient-Assisted Living Ecosystem”, accepted and presented at IEEE HealthCom’13.

References

[1] U.N.P. Fund. Population ageing: A larger and older population, June 2009.

[2] AAL4ALL. Ambient Assisted Living For All, 2011.

[3] European Commission. CE marking, June 2013.

[4] ISO/IEEE. Health informatics – Point-of-care medical device communication – Part 20101: Application profiles – Base standard. *ISO/IEEE 11073-20101:2004*, 2004.

[5] IEEE. IEEE Standard for Software and System Test Documentation. *IEEE Std 829-2008*, 2008.