Telematics Terminal Platform Testbed Technologies for Open Platform Test

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Abstract: In the telematics industry, the development of an open telematics terminal platform technology will be a great contribution to the telematics industry with an interoperability and adaptability of the telematics services. This paper proposes a terminal platform test process and a prototype of terminal platform testbed systems for an open telematics terminal platform test.

Keywords: telematics, test process, testbed, open terminal platform

1. Introduction

Telematics, a newly convergence technology making a car as the digital life space, is composed of the terminal platform technology, the server platform technology, the communication technology and the positioning technology like Fig. 1.

As the development of the each component technology of telematics, the standardization of the technology and the research of telematics testbed technology are now under way actively. Telematics testbed technology, the test and evaluation technology for the interoperability and standardized development of the each component technology, can be composed of the component technology testbed and the integrated technology testbed.

Telematics terminal platform testbed that is one of the component technology testbed to test the open telematics terminal is described in this paper. The outline of the paper is as follows: The section 2 suggests a terminal platform reference model to be tested in the developed testbed. Then, in section 3, we propose test process model includes test cases and test procedure, and implement the terminal platform testbed to test open terminal platform based on the reference model.

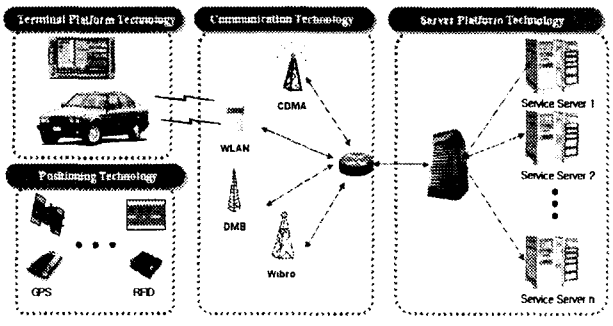

Fig. 1. Overview of the telematics technologies

2. Reference Model for the Terminal Platform

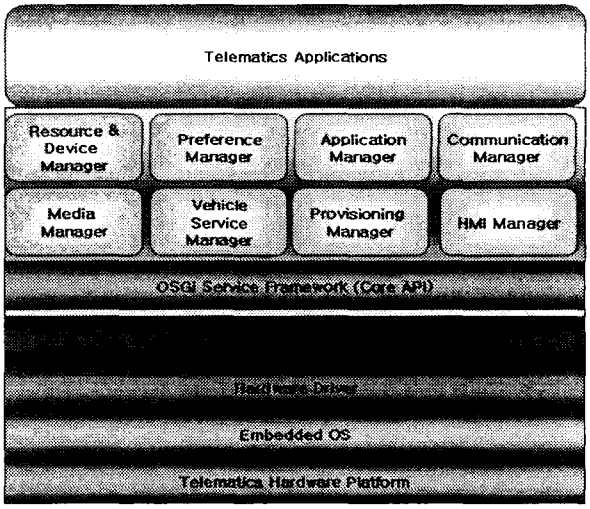

Fig. 2. The reference model of open terminal platform

Telematics terminal platform which is in vehicle hardware and software device to deliver various telematics services such as transport information services, location based services, entertainment and etc. to a driver and passengers through the wireless communication networks(CDMA, WLAN, DMB, Wibro and so on) consists of terminal service applications, software platform and hardware platform.

Fig. 2 shows the reference model of the open terminal, Based on this model, test process and testbed system is developed to test this model.

1) Terminal service applications

Telematics service applications provide a lot of telematics services to the driver and passengers from server platforms through wireless communication and can be classified like table1 [1].

Table 1. Telematics services

Services	Description
Location based services	Navigation, POI and etc. based on the location information of the vehicle.
Information services	M-Commerce, news, weather, real time traffic information service and etc.
Remote management and emergency services	Remote diagnosis and management of vehicle. Safety and security service on the emergent situation.
Entertainment services	Mobile game, music, karaoke, cinema, and etc.
Mobile office services	E-mail, word processing service in vehicle

2) Hardware platform

Hardware platform technology is to develop terminal hardware device, other devices and device driver to interface hardware devices.

3) Software platform

Software platform technology is a middleware technology making it easy to develop service applications, to provide and to manage them. The main stream of software platform technology is the open platform technology for interoperability, adaptability and extendibility. The good examples of open platform are VEG(Vehicle Expert Group) of OSGi(Open Service Gateway Initiative) and AMI-C(Automotive Multimedia Interface Collaboration). OSGi defined various vehicle APIs through VEG activity [2]. AMI-C, as one of the in vehicle multimedia standardization organization, is taking a lead in terminal platform and vehicle interfaces standardization based on OSGi platform [3].

The suggested reference model in this paper is made up of OS(WinCE.net, Embedded Linux), Java Virtual Machine, OSGi Framework and various service managers.

3. Test Process and Testbed System

1) Terminal platform test process

a)Test items

Terminal platform test items are made up of standard test, function test, performance test and stability test about hardware platform, software platform and service applications. In this paper we will just consider software platform test.

Table 2 describes test items in detail.

Table 2. Test items

Test	Description
Standard	Test for suitability of APIs defined in the standards - API naming - number of input variables - data type of input and output variables
Function	Test for the function as normal and abnormal input - check the expected result from the valid input and functionality with the valid arguments - check the exceptions from the abnormal input and arguments
Performance	Test for the performance of the platform as the repeat execution of the specified API with defined interval and frequency - check the average response time - check the average resource share - check the percentage of the successful execution.
Stability	Test for the stability of the platform as the simultaneous execution of multiple devices such as virtual auto system, positioning system, server platform and etc. - check the average response time - check the delayed time compared to normal condition

b)Test cases

Test cases used in this paper are OSGi service platform APIs and telematics service APIs-Application Execution APIs and Vehicle Service APIs- based on OSGi platform and test is executed using them. Test cases refer to the test case specification of *IEEE std. 829-1998 IEEE Standard for Software Test Documentation [4].*

c)Test procedure

Test procedure defines the flow of the test execution. Test procedure refers to the test procedure specification of *IEEE std. 829-1998 IEEE Standard for Software Test Documentation.*

2) Terminal platform testbed system

Terminal platform testbed system is physical and functional environments or systems to test and evaluate the performance and quality of the desired functions, the applications and contents. It composes of the test system, the test management system, the testbed management system and virtual auto system.

Fig. 3 shows the architecture of testbed system.

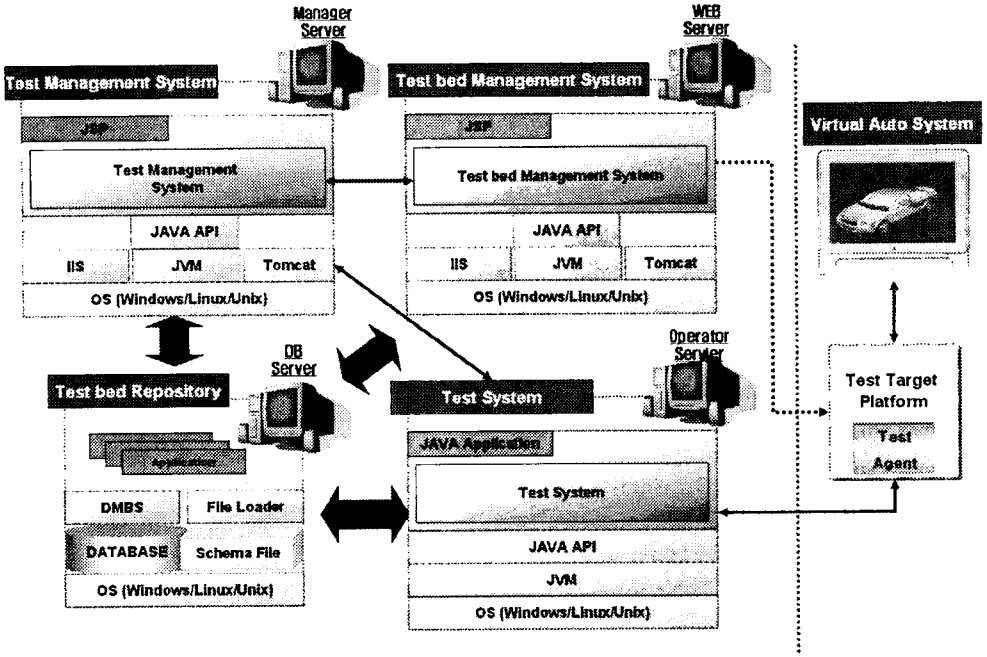

Fig. 3. Architecture of Testbed System

a)Test system

Test system executes the terminal platform tests-standard, function, performance and stability) with other testbed subsystems, analyzes the result and makes the test report. Test cases are executed using test agent installed in the target platform as defined test procedure. Test system has test engine, test agent controller, interface handler and other interface modules.

Fig. 4 shows the architecture of test system.

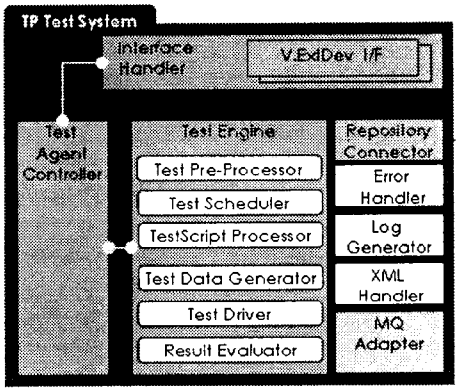

Fig. 4. Architecture of Test System

b)Test management system

Test management system manages the overall test processes including test case manager, test suit manager, test configuration manager and analyze test log.

Fig. 5 shows the architecture of test system

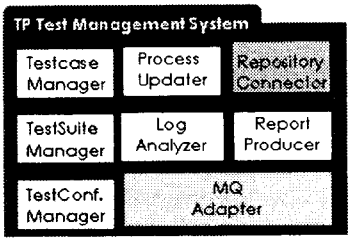

Fig. 5. Architecture of Test Management System

c)Testbed management system

Testbed management system carries out the control and setting up of the testbed subsystems such as virtual server and virtual device and manages user groups, testbed users(administrators, requesters and testers), test requirements from the test preparation to the test end.

Fig. 6 shows the architecture of testbed management system

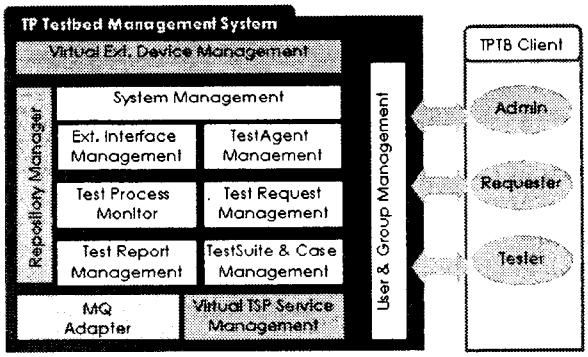

Fig. 6. Architecture of Testbed Management System

d)Virtual auto system

Virtual auto system that is the virtual emulator environment of the car networks containing mirrors, airbags, windows, seats, air conditioner and so on controls devices related car and monitors them. It provides interface with terminal platform using CAN(Controller Area Network) protocol.

Fig. 7 shows the architecture of virtual auto system.

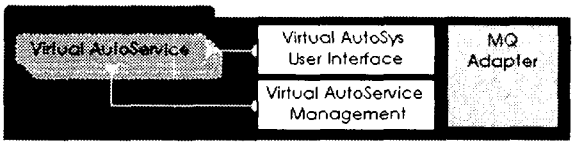

Fig. 7. Architecture of Virtual Auto System

4. Conclusions

In this paper the terminal platform testbed for testing software platform was developed and terminal platform reference model was suggested to define test process. We defined the test process including test cases and procedure and implemented testbed system containing test system, test management system, testbed management system and virtual auto system.

The developed testbed and it's technologies can be easily adopted to the test and evaluation of the open terminal platform standard and it will play a key role in the proliferation of the telematics terminal platform industry.

References

[1] *INVS and JAVA Technology - Blueprint for the Future, An Industry Perspectives*, Sun microsystems

[2] *OSGi Service Platform Release 3*, OSGi.

[3] *AMI-C Release 2 Architectural Overview*, AMI-C

[4] *IEEE Standard for Software Test Documentation*, IEEE Std 829-1998