

A System-Level EMC Technical Support Platform for Network-Based Computers

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Abstract— This paper describes a methodology for developing an effective electromagnetic compatibility (EMC) computer-based Technical Support Platform (TSP) system which is used for the analysis, prediction and design of system-level EMC. This computer-based TSP is integrated by EMC resource databases, specifications modules, EMC design module, platform management module and EMC analysis tools. The main advantage of such a system over conventional EMC software is that the platform is based on Browser/Server structure, which is developed by JAVA language so that it can be used for EMC engineers to operate on a personal computer in the local area network operated at conventional WINDOWS system environment. In addition, the platform does not require the users to be a skillful expert in system-level EMC design but it is easy for the users to complete EMC design based on the operation guide procedures. This platform has been used in the IT production for system-level EMC designers.

I. INTRODUCTION

Effective EMC design and engineering management for electronic product development and manufactures are very important in the quality control system. It is an urgent to find an effective way to realize system-level EMC design standardization by using advanced electromagnetic prediction tools or expert system^[1,2]. It is evident that computer-based tools are extremely useful for ensuring EMC in the earlier stages of design to fix EMC problems, especially for system-level EMC designers^[3]. For those reason, a computer framework based knowledge systems for EMC analysis was developed^[4]. In recent years, with the revolution of electronics and communications industry was going on, the electronics industry developed issues and concepts those were addressed to allow interoperation of the systems in the presence of each other and with the external environment. EMC developed over the years, and has become a specialized area of engineering applicable to any area of systems that included electronics and communications. Many well-understood aspects of EMC have been developed, just as many aspects of electronics systems have been developed. However, in practice, there are vast numbers of electronics designers and technicians without an understanding of EMC knowledge, and many specialized and competent EMC professionals that are not experienced in the electronics and communication industry. Over past

many years, EMC engineers in the institutes or enterprises have produced different EMI prediction software for all purposes, and accumulated lots of design EMC design documents, EMC specifications, EMC standard files, includes EMC tested record, standard device parameters, design rules documents, user's handbooks, trouble-shooting guide, specification data, and personal experience reports in the design of system level EMC covering different stages of the product life period. However, those EMC documents or software are isolated each other, they have not been completely integrated into an usable software body. What's more, the problems are that those EMI prediction software modules were developed at different historical stages under different computer operation environment, using different programming languages and different type of software structure. It is not only a waste of EMC resources but also it is inconvenient for EMC designers to make use of those achieved experience for high efficiency EMC design and management. It is worth noting that how to apply those valuable documents to effective EMC design for an EMC designer. For this reason we proposed an approach to the integration from those isolated document, database, software, etc. for local area network applications by using an EMC "TSP" concept based network operation environment. In this paper we present a new method which is an EMC Technical Support Platform for system-level EMC analysis, prediction and design using network-based computers. In this way, the EMC analysis, prediction, design and database with state of the art simulation tools can be integrated into a unified operation platform, so that the designers can do effective design during whole period of the production life. In addition, in this platform, MATLAB interface with some commercial EMI prediction software and other numerical codes are provided so that the simulation modules in MATLAB itself can be used for integration. Such a system over conventional software is that the platform is based on Browser/Server structure, which is developed by JAVA language, it is suitable for EMC engineers to use a personal computer in the local area network operating under conventional WINDOWS system environment. In this system, the platform system only uses simple rules of thumb, to identify potential electromagnetic interference in a system-

level EMC design consideration. This paper mainly discusses how to integrate a technical support platform with network applications in R&D of electronic products, and further explains the architecture and the function realization of the platform system based on network-based computers application.

II. ARCHITECTURE OF THE TECHNICAL SUPPORT PLATFORM SYSTEM

The design consideration for the platform system architecture based on network computer applications should be openness, portability, and expendability, in addition, it must have following basic features:

- 1) internationalization obey the current international standard.
- 2) compatibility have the favorable interface obey the correlative standard and criterion, and have the compatibility downwards and upwards.
- 3) modularization can be loaded and offloaded based on the different standard following the conception of package.
- 4) individuation prescribe the lowest standard for the immature trade and allow to make different choice based on the requirement.

On the other hand, the platform based on network should absorb the experience of the former information system and pay attention to following several construction consideration:

1. The usability is the core power for the network computer application in a local area network.
2. The platform based on network computer application must better serve each kind of practical user.
3. As the EMC TSP based on network computer application is the peripheral application of network, it is essential to walk the path of application innovation.

For the users, they may have different level of EMC design requirements, including system level, sub-system level, board level and component level. Some are experienced engineers and some are beginners. In addition, EMI prediction techniques involve multi-aim and complex EM environment, the designers of the platform development should consider the applicability, usability and platform system architecture features. Using this system-level EMC design platform, designers can complete analysis, prediction, design and evaluation for product R&D at the design beginning stage by searching design guidelines and advice, identification of relevant EMC regulations and test procedures, assistance in interpreting the results of numerical simulations from the server.

The EMC TSP architecture designed for network-based computer applications is described in Fig.1. It is composed of different support modules having the function to search EMC technical resource. The details are as follows:

1. The module 1 is functioned as safeguarding the EMC technical resources, including all database.
2. The module 2 is used for the system-level EMC design.
3. The module 3 is for the analysis and simulation of system-level EMC.

4. The module 4 provides the learning and training for system-level EMC designers or engineers at any stage of project period.

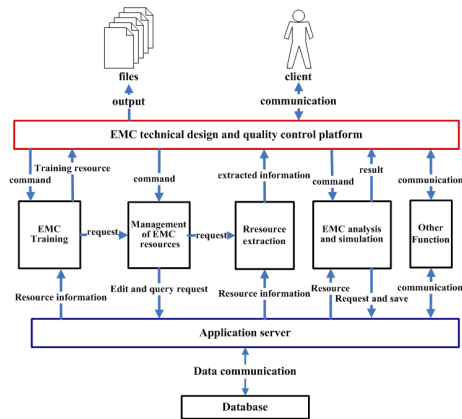


Fig. 1. The architecture of the EMC design platform based on network computer applications

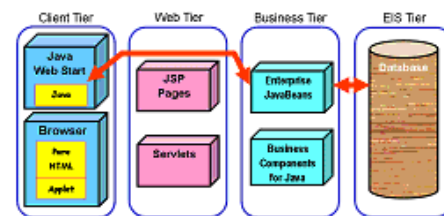


Fig. 2. Framework based on network using Java technology

III. FRAMEWORK DESIGN BASED ON JAVA TECHNOLOGY

The framework of the platform structure for network application is shown in Fig.2. The database frame includes:

- (a) EMC test database module
- (b) EMC environment database module
- (c) Technical standard database module
- (d) EMC component parameters database module and product parameter database module.
- (e) design rule document database module
- (f) user's handbooks and component specifications

Design rules checking (DRC) module is in the database. Those tools are used for the guide to the designers to make decisions as early as possible so that the rules can be used as the design progresses. Some rules were developed from design experience.

For the database design, the ever-increasing information data upgraded frequently must be considered. In some database, confidential data is required. For the database searching and inquiring, it should have special authority to the user according to different user's log-in name.

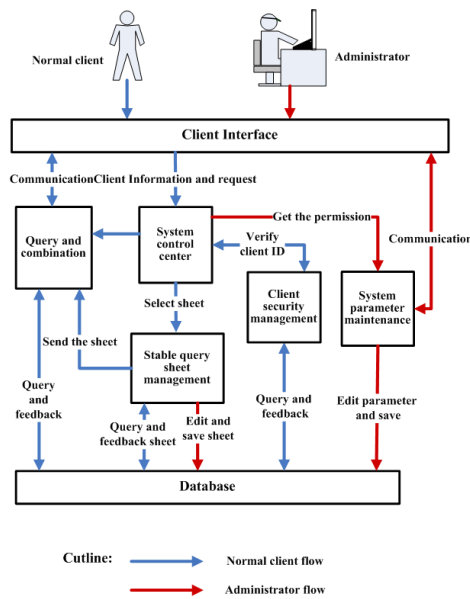


Fig. 3. Inquiry and search structure

A. Authority categories for search and query

Fig.3 Inquiry and search structure shows the authority categories for search and query function:

(a)For EMC professional designers users.

In this party,they are advanced EMC experts which are in charge of EMC technical management work,they also are the system manager and VIP users.

(b)For Electronic production designers users.

In this party,they are technicians which are majority users in this local area network range because their work has to do directly with EMC problems in the design of production.They need to be supported by EMC professional designers from the platform

(c)For Management staff users:

In this party,they are non-electrical engineers,or rear service persons,or other administration officers.They are not the EMC designers but they need to know some EMC basis through this platform.

For those reason,the system adopts mature technology and uses standard API(Application Programming Interface) as the foundation of the ground floor of programming building the foundation for future software development.

B. Language used in the TSP system

Java Web Start (JWS) technology is used in the realization technology of the system platform. JWS is an application-deployment technology that gives you the power to launch full-featured applications with a single click from your Web browser having the convenience that B/S structure uses and including the security features of the Java 2 platform. It is regarded as the mainly basic platform, so that we can easily

expand other systems of B/S structure on it. The advantage of the issue and maintenance of JWS system can be competed in the server side. Under the consideration of the general security, and not increasing the burden of the user's terminal, JWS offers the wide space in expanding B/S system in the future.

As one of the function in this platform, SPRING framework^[5], combined with STRUS^[6] and Hibernate^[7], are used as Searching Engine system. STRUS is a framework used to deal with sessions in the front of the network application. The connection of databases is realized using hibernate.

C. Simulation application

As an efficient scientific calculation software, MATLAB is widely used in many engineering fields. In the design, we link the powerful computational function of MATLAB into this network application to expand the EMC design ability of the platform.

MATLAB offers one network engine named MATLAB Web Server which is a B/S structure. Then it can be combined under the JWS platform. In addition, it is necessary to make use of JSP technology to realize a training system of B/S structure. The purpose is to offer teaching and guidance of the knowledge of EMC in the multi-level and ranks, and also supply technical support and user guidance to this EMC platform system.

IV. FUNCTIONS OF THE TSP SYSTEM

A. management and maintenance

The management and maintenance for the platform include:
 (1)Management and maintenance for EMC knowledge database,trouble-shooting document,and other technical regulation files.

(2)management and maintenance for the design files and templates produced during the product design at different flow stage.

(3)management and maintenance for the knowledge database produced during the product design at different flow stage.

(4)management and maintenance for experienced files submitted by user for adding or revising.

(5) management and maintenance for system operation I/O interface.

B. EMC Education and Training

In this mudule,it contains search & inquiry system for the EMC knowledge guidelines,EMC trouble-shooting files,EMC standard documents and regulation and EMC design files.This module provides:

(a)EMC terminology, standard and regulation.

(b)EMC training courses and textbooks.

(c)EMC technical literatures and electronic magazines.

(d)EMC design skills,EMI model and computational algorithm.

User also can input/output relevant EMC technical documents according to the required conditions.

C. EMC Design

For a specific product EMC design, the design module employs tree-folder document structure, it contains EMC models, antenna layout, internal isolation, T/R module positioning, frequency spectrum distribution, power source, grounding design technique, protection techniques, sub-system interference, system-level and PCB-level analysis. Engineers can realize EMC prediction for making optimized decision.

D. Check and search for EMC trouble-shooting

Designers can choose the EMC trouble phenomenon provided by the system to search relevant trouble reason.

E. On-line simulation and computation

The module utilizes the MATLAB Web Server package provided by MATLAB toolbox as EMC on-line simulation and computation. The calculation search engine can be expanded to the platform for on-line simulation and computation. Fig.4 shows the flow of on-line simulation using MATLAB toolbox for local area network computer use.

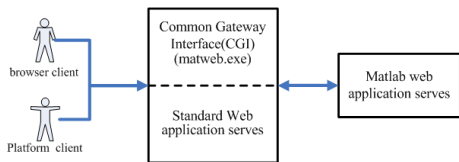


Fig. 4. Inquiry and search structure

V. USER'S CATEGORIES DESIGN FOR THE TSP SYSTEM

(a) For advanced EMC engineer users: They are professional EMC engineers who are in charge of the EMI prediction for whole system in the production, which is system-level EMC design. They have a good knowledge of EMC standard, regulations and some other special requirements. They can manage whole engineering project by this platform so that they can monitor the project progress and potential EMC problems. On the other hand, they are real experts and have accumulated much experience in EMC design and management. They can guide new techniques, new regulations and new solutions for the platform information upgrading.

(b) For the sub-system users: they can search relative design requirement. They also can make use of EMI models given from the platform to do simulation and quantity analysis by using inquiry engine. At the same time, they also can learn relevant EMC theory from training module according to the EMC problems they met.

(c) For EMC engineer beginners: they can learn EMC knowledge from this platform, even they can do basic calculation and simulation using some EMI models provided in the module. This module also is suitable for the management officers.

The user categories determine the structure design based on the limit of authority for search engine

VI. CONCLUSIONS

An effective computer-based EMC TSP constructed by EMI prediction software, database, EMC analysis, EMC test, EMC training and tools integration to form a system-level EMC design framework is proposed and realized. This platform allows to manage EMC data and to tackle various EMI problems during the R&D of electronic system. A search engine constructed by SPRING framework, combined with STRUS and Hibernate techniques is described. This platform provides an interface between the EMC analysis module and MATLAB program which contains powerful simulation tools, computational code and drawing program for online use. This platform system combines the Relational Database technique, browser/Server visiting technique, network framework for integration. It is of design intelligentize and easy operation, and it has been used for system-level EMC analysis, prediction and design using network-based computers.

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