

AN ANALYTICAL POINT OF VIEW ABOUT MAINTENANCE PROCESSES FOR DISTRIBUTED APPLICATIONS

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ABSTRACT

Maintenance processes is an important phase in the life cycle of online distributed applications, making it necessary to ensure their easy assistance after deployment of the application currently in use. Data mining from data sets collected from a third party application that stores raw data about maintenance processes in the application management provides valuable information for determining statistical study of the distribution and consumption of resources on the types of maintenance categories.

Keywords: maintenance; maintainability; distributed web applications; html structures; maintenance processes; maintenance metrics.

The need is the increasing complexity of distributed applications and to meet user requirements by providing procedural and maximize performance for distributed applications maintenance processes. To achieve the objective are defined means:

- To study the concepts of maintenance activities;
- The study of maintenance typologies for distributed applications;
- Maintenance process models are studied;
- Defining maintenance model for distributed applications;
- Identification of standards for distributed applications through relational content;
- To study the structures and characteristics of quality for distributed web applications;
- Identifying the metrics and indicators of maintenance;
- Define ways of assessing the maintenance process of distributed applications through specialized monitoring.

The paper is structured into eight chapters and defines processes for allocating and managing resources by adapting instruments to the requirements of the objective pursued. For evaluation metrics are defined, quality characteristics are measured and compared to the results obtained.

In the chapter entitled ***Distributed applications*** are presented basic concepts that are characterized by distributed applications, from a technical standpoint, based on advantages and disadvantages derived from the implementation. Generators are defined and functional architectures of distributed applications. Performance factors are defined as features with lots of quality measurement and metrics. Technical characteristics of distributed application development are: data replication, the existence of connection components, synchronization and security. Data replication and synchronization required standards are constantly add and reconsidered and their purpose lies in the need for

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synchronization between distributed applications, incorporating the necessary support and maintenance of interoperability in the industry. Factors that measure the performance of distributed applications implementation architectures are accessibility, reusability, stability, consistency, quality, increased productivity, and increased efficiency of users working remotely, financial savings, flexibility, scalability and maintainability.

The life cycle is defined as the methodology for object-oriented UML model. Adapts the model by adding life cycle maintenance phase, which is essential for distributed applications. Maintenance phase is added in the UML model as a complement to the standard model and requires UP and monitoring control operations necessary to solve successive errors and to refine the result obtained through the implementation of the functional parts of the system. Maintaining the life cycle of distributed applications requires corrective action to resolve problems identified through testing operations required validation functions of application modules.

Target group is defined by analysis, identification, organization and size of distributed applications. Distributed applications have as a starting point in design requirements and information needs of the target group. Designing distributed applications based on the needs of the target group must follow the following characteristics:

- The application contains a hierarchy of permissions which allows the overall application security and confidentiality and accessibility of data between users;
- Intuitive interface application contain elements that are found similar in name and in other applications as usual;
- Internal reference of the application to be intuitive, and ways to access information should be short and quick.

Types of structures are defined in the referential levels of distributed applications and how to identify the degree of satisfaction of users with indicators for determining the frequency of access to certain referential levels. Types of distributed applications are defined by listing their purpose and functioning in interaction with end users. The types of distributed applications are divided according to their development and utility of the target group represented by distributed applications:

- Information on issues of general interest by accessing public information and private aspect in accessing secure information through user accounts;
- Planning and appointment setting out the terms and conditions of activities that require a strict separation of time and space concerned;
- Carrying out electronic payment orders and actions to meet commercial and remote electronic management of large numerical values;
- Electronic markets and business ads to ensure the meeting of supply and demand in an electronic environment that broadens the scope of advertising and negotiation activities in cyberspace;
- Searches conducted to identify a short wide range of data items that require complex algorithms of artificial intelligence that selects the information required by the target group through semantic queries and filtering large informational content.

In the chapter entitled ***Ensuring maintainability for distributed applications***, standards and concepts are defined. Types of maintenance, relations and their characteristics are defined by analyzing the efforts of participants. Maintenance tasks are defined by various different categories of its purpose: *perfect* to improve system performance, adjusted to add or change functionality; *corrective* to correct errors in the existing system, which involves changing the coding of the program source code without affected functionality, *preventive* maintenance changes to prevent future programs, that change goes to mentenabilității software programs; *reductive* amending the program to limit or eliminate user accessible functionality, *extensive* programs for amending the replacement, addition or extension functionality accessible to users. Insurance of distributed applications maintainability in order to identify actions characteristic of the type of preventive maintenance that involves the preparation of application for maintainability and reliability for the better future made improvements.

Maintainability is defined as part of preventive maintenance. It defines what triggers the decision tree maintenance types. According to different conceptions of the division of the types of n-tier architectures, distributed applications are divided on several levels in terms of distributing applications on different computer units as workstations or servers that interact and react within the existing links between them or, in terms of architecture that separates the components of the program logic internal applications as independent and completed by the diversity and complexity of functionalities.

Operational and logical division distributed applications, allowing easy implementation of maintenance by identifying and treating each component separately while ensuring facilities for reducing maintenance complexity of maintenance processes subsequent to implementation. It examines the implementation of maintenance character within the logical structure levels of distributed applications. To ensure the maintenance of the presentation level custom visual themes are implemented to ensure easy deployment of graphical interfaces. The maintenance of the business level is ensured by implementing modular structures of distributed applications that reuse data structures. The maintenance of the data access level is ensured by implementing the abstract class type interface ADOdb for distributed applications with databases of information processing depository.

In the chapter entitled ***Modeling maintenance processes*** a maintenance process is defined, through concepts, standards and structure maintenance processes activities and tasks by type of maintenance. Maintenance processes are reflected by changes in the management of projects involving activities like designing complex applications with deployment times and reduced development costs, even taking action on the components of distributed applications already in place and functioning in an online environment. Maintenance processes involving conducting succession of phases, activities and tasks that make up a baseline architecture defined by a trigger and a final moment of validation actions.

The maintenance model has features, actions and options to solve through the types of maintenance. A model for the development processes is proposes for distributed applications called MPMAD. Tasks are presented through detailed flow scheme actions. There is defined a distributed application, which is necessary for organizing the management tasks and to provide further data sets required to assess maintenance

processes. Maintenance processes for distributed applications involving a range of activities are determined by the environment in which they operate. Distributed environment involves accessing applications in a shared environment. Distribution in a shared application determines following activities:

- Analysis of causes triggering processes by identifying maintenance requirements of the legislation, the needs of the target group and the shared environment that is called distributed application by accessing real-time and the temporary connection that provides real data synchronization and replication;
- Adding new processing sequences and procedures in the competitive environment for data access by adding new features to improve application performance distributed computing;
- Sequences and procedures change the source code and database structure to adapt to technological change and the requirements imposed by the target group needs and current legislation through implementation of other formulas and optimization solutions for the calculation;
- Elimination of internal sequences and procedures determined by the impossibility of distributed applications to adapt old procedures or functions futility;
- Test in a shared environment that requires the involvement of users in real-time reporting of issues arising from operation and performance evaluation after making changes to the application structure and database structure based on meeting the need for obtaining a requested information as soon as possible;
- Real-time implementation of the new versions from old versions running parallel to ensure proper sizing changes made based on the characteristics and operating parameters;
- Management by recording all activities in a management application to conduct maintenance processes.

It is presented the staff, technology, equipment and duration necessary to carry out the maintenance process. The maintenance model has features, advantages and disadvantages of the types identified in the maintenance process.

In the chapter entitled ***Maintenance processes metrics*** are defined two ways of evaluation. The first way refers to an internal maintenance processes of distributed applications. The second refers to an external maintenance processes evaluation of distributed applications. In the internal evaluation metrics are analyzed based on data sets obtained and identified in the distributed application for managing the maintenance processes. It examines how time is consumed in the maintenance process unit on types of people, and maintenance tasks. In the external evaluation, metrics are analyzed based on data sets obtained from a user behavior monitoring module. External evaluation refers to the analysis of data sets through monitoring algorithm which compares the moments of time available before and after the maintenance process. By comparison of development metrics the success of maintenance performed is determined.

The metrics are analyzed to identify features and general aspects of the values obtained from evaluation processes are both individual and summarized. Based on the average duration of tasks carried out within several maintenance processes, estimation of a norm

duration of the tasks currently running scroll through specific activities are obtained. For norming duration of maintenance processes tasks are built indicators needed to determine the average duration values by measuring actions automatically.

The first area of action is based on evaluation of data acquired automatically by the software algorithm InfoMon to manage and centralize tasks performed as part of maintenance and working sessions of users. Using maintenance management processes and steps to resolve the requests for release process provides necessary and sufficient raw data to assess maintenance processes. Through the management of application maintenance processes, called InfoTicketMent, we obtain the following information on InfoMon algorithm for evaluation:

- Moment of starting the process by registering new requirements that describe the problem identified by the user or user group;
- Transition to a new task when made by filling in the application management;
- When completing a final validation of the changes made by the trigger;
- At the completion of tasks by recording date and time of termination of operations;
- During the running of the process determined based on data in the application management;
- Time required to transition from one activity or task to the next by the difference between the starting point of the next tasks and task completion time past;
- Number of persons designated in the process by identifying the value specified in the application management.

In the chapter called *Maintenance metrics for the InfoS application* an distributed application is designed that meets the criteria for maintainability and serves as a tool in the characteristic activities of news agencies. The *InfoS* application, available at www.amosnews.ro is developed on a model type of representation and functionality of Content Management System complying with the force structure and accessibility to such a structure implies the existence of Web functionalities:

- Structuring the users accounts that allow assignment of permissions and access rights for protected or public areas of application;
- Modular functionality in order to inform users of a system giving them access to desired information and hierarchical algorithms for retrieval of data;
- Structural maintenance modules to ensure the necessary flexibility in triggering maintenance processes types:
 - *Correction* which improves the internal functions of the application based on changed conditions at the structure;
 - *Adapted* by that change and add features based on application requirements running migrated to a new environment and new operating conditions;
 - *Perfective* by adding new functionality and construction of application modules that provide added value;
- Customized by user interfaces by providing facilities for users with dynamic interaction and retrieved information displayed in the application.

The *Infos* distributed application is designed based on the requirements of the target group and contains separate modules for different functionalities required distributed information applications. It presents original solutions to resolve the situations encountered as part of maintenance processes.

The solutions resulting from maintenance processes are employed by type of maintenance. As part of corrective maintenance performed on the application *Infos* internal references are reorganized. The distributed application has a incorporated module that *Infos* aggregated by specialized algorithms for monitoring data sets and determining user behavior. This module is called InfoMon and is used both in the development of statistics to analyze access and external metrics needed to assess maintenance processes. Maintenance processes are evaluated based on data sets for internal and external evaluations. There are measurements performed and drawn conclusions for the maintenance performed.

In the chapter entitled ***Contributions to disseminate the results*** are presented and written articles published in nationally and internationally recognized journals for highlighting results of the research process of distributed applications maintenance. The research was conducted across six years of study. In time for the study were distributed applications made, which led to the investigations and measurements, developing a model for carrying out maintenance processes and methods of evaluation of these processes. They have shown their functionality and utility to users needs. Developed applications are running on the Web and are accessible to visitors, both nationally and internationally through the introduction of Multilanguage display.

Completed applications have implemented technical solutions to ensure easy maintainability to conduct subsequent maintenance processes. Applications developed are implemented and running on separate Web servers with access to databases and to balance processing power for security and data integrity. On distributed applications made by the author were carried out maintenance processes that have improved operating performance and functionality offered to users.

Were also presented works that were achieved and sustained during the period of research at national or international conferences or have been published in journals indexed CNCSIS or international databases.

Conclusions are summarized in the chapter for presenting solutions that can be drawn from this work and future research directions are set. It presents findings on the processes of maintenance of distributed applications, running on the basis of models that are made up of carried out activities and tasks to be undertaken to resolve issues and requirements raised by a trigger.

Original solutions obtained by the author and included in the thesis are:

- Adding life-cycle maintenance phase for distributed applications in UML object-oriented methodology;
- Define maintainability as a quality characteristic for developing distributed applications;

- Introducing stage maintainability of distributed applications on their organizational logic levels;
- Modeling activities and tasks required in a process of maintenance for distributed applications by defining MPMAD model;
- Defining maintenance processes for distributed applications to be generated by a representative of the target group that operates in the live distributed application;
- Ranking features and functionalities of applications necessary to manage the processes of maintenance activities;
- Build metrics needed to assess maintenance processes for distributed applications by separating and comparing the values obtained before and after maintenance actions;
- Identifying how to obtain a normal value for estimating the duration of maintenance processes that are in progress or to be undertaken;
- Designing an algorithm for automatic data acquisition required maintenance assessment processes;
- Design, development and implementation of a real operating environment maintainable distributed applications on which it performs maintenance processes.

The topic discussed is a particularly important area for scientific research and especially for computer science applied to economics because:

- Distributed computing applications are a particularly high level of complexity;
- The number of users and their level of heterogeneity is high;
- Resource allocation is performed in real time and any error is reflected by penalties and risks that are reflected by diminishing profit investors;
- Have brought security component which aims to determine authorized processing and control and limit unauthorized or accidental intervention on databases and software components.

Maintenance should it be seen as a process that occurs when:

- Evolving problem by modifying processing modules;
- Change the structure of the target group changed;
- New elements in the IT & C revolutionizing human-computer application must include in order to remain attractive.

All these factors lead to accumulation requiring:

- Calculations that indicate the need to develop a maintenance process compared to trigger the acquisition of new applications;
- The optimal timing should begin the process of maintenance;
- Identify specific conditions which can carry out a maintenance process.

To achieve a correct and complete evaluation maintenance processes must:

- Understand the exact features distributed applications;

- Set specific conditions for conducting maintenance;
- As stated contents feature called maintainability;
- Specific metrics constructed maintainability;
- Check all elements defined in theory on an application that is subject to a maintenance process.

As a result of research conducted in this work are formulated new directions of study and analysis for obtaining and interpretation of statistical and technical standpoint, the series features larger dimensions to processes carried out maintenance.

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