2 Proposed Solution: The Data Warehousing Approach

The experimental evaluation of dependability is a multidimensional problem. The readouts collected during an experiment (called facts in the multidimensional jargon) are analyzed according to groups of experiment features called dimensions. For example, raw data representing things such as error detection efficiency or error recovery time are facts, while the dimensions represent the different target systems, configurations, workloads, faultloads, etc.

Our proposal is to used data warehousing and OLAP (On-Line Analytical Processing) technologies [2] to store raw data from different experiments/setups in a common multidimensional structure and use commercial OLAP tools to analyze the results (see Fig. 1). The OLAP tools allow easy computation of measures from the facts, filtered according to the attributes of the dimensions. By using different filters over dimensions attributes, the user can isolate the effect on the measures of specific aspects (dimension) such as different workloads, target systems, faultloads, etc.

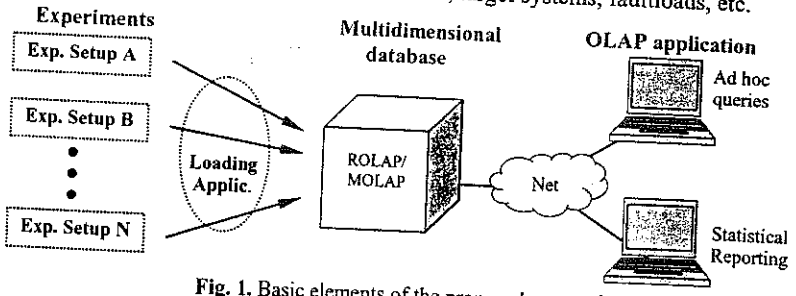

Fig. 1. Basic elements of the proposed approach.

The main advantages of the proposed approach are the following:

- The data warehousing approach [2] has proved to be very effective in the integration of heterogeneous data from different systems in a common repository.
- The data warehousing and OLAP technologies are mature and readily available.
- The life cycle of a data warehouse already includes steps such as multidimensional scheme design and data cleansing [2] that assure the raw data from different sources stored in the data warehouse is consistent. Actually, this is a central requirement of data warehousing to assure the analysis produce correct results.
- A data warehouse repository is an effective way to share experimental data among different teams or to make experimental data available in the Internet. Furthermore, as the data warehouse stores raw data it means that it is always possible to repeat the analysis or to perform a different analysis over the same raw data.

The proposed approach is being used in the DBench project [1] for analysis and cross-exploitation of results from several experimental setups from different partners.

References

1 K. Kanoun, J. Arlat, D. Costa, M. Dal Cin, P. Gil, J-C. Laprie, H. Madeira, N. Suri, "DBench: Dependability Benchmarking", Supplement of DSN-2001, Chalmers Univ. of Technology, Göteborg, Sweden, 2001, pp. D12-D15.

2 R. Kimball et. al, "The Data Warehouse Lifecycle Toolkit", Ralph Kimbal, Ed. J. Wiley & Sons, Inc, 1998.

Model-based dynamic reconfiguration in complex critical systems

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1 Introduction

Fault-tolerant techniques are widely applied to allow a system to provide an acceptable level of service in spite of faults occurrence. The best fault-tolerant strategy to employ depends not only on the kind of faults to be tolerated but also on other characteristics of the system and of the environment in which the system is called to operate. For example, in case of a distributed system, the presence of multiple hosts communicating through a computer network adds variability on the system resources available in case of faults (for example an host or a link can be down). Among other sources of variability we mention the change of applications' dependability requirements during the operational time, or high varying traffic e.g. in telecommunication systems, or the usage of COTS components in building dependable distributed system, as increasingly dictated (mainly) by cost reasons.

The above considerations reinforce the need for a general dependability manager solution, able to react dynamically to variations of the system and/or environment characteristics in order to achieve the desired dependability level. Our group has recently started to approach such problem, and the framework of the IST-2001-38229 CAUTION++ project, going to start on 1st November 2002, offers a challenging opportunity to investigate on this topic.

2 The Approach

We follow a model-based approach in the definition of such a general dependability manager. The idea is to build simplified (but still meaningful) models of the system to be controlled. These models need to be solved dynamically as quickly as possible to take appropriate decisions online. In fact the manager must monitor system and environment conditions through simple but yet effective indicators. As soon as a system reconfiguration is required (because of fault occurrence, applications' request, traffic conditions, ..) the model solution helps to devise the most appropriate configuration and behavior to face the actual situation. For example, through the model solution it

can be evaluated the dependability of a new architecture of the system obtained by rearranging the remaining resources after a fault, or some performability indicator to carry out cost-benefit tradeoff choices. Therefore, the output provided by the dependability manager is a new system configuration; of course, it is expected to be the best reconfiguration in order to satisfy the (possibly new) dependability requirements, following the reconfiguration itself. Different modeling techniques and models solution can be considered and integrated to reach the goal.

A general framework should be pursued, not tied to a specific application but flexible enough to be easily adapted to different problems. In particular, a methodology has to be defined, allowing to identify systematically the input parameters of the manager, the metrics of interest and the criteria to base the decision on.

The idea of a dependability manager is not new; here, the innovation is in the methodology of using the modeling approach to make decisions online. This approach has been also exploited in our previous study devoted to investigate the consistency of database subsystems involved in communication systems (e.g., telephone systems), where appropriate scheduled maintenance policies are necessary [1, 2]. There, the goal was to devise an audit manager attempting to find an optimal online balance between contrasting requirements, namely satisfactory database availability and low overhead due to audits.

The CAUTION++ project focuses on the telecommunication area; its main objective is to design and develop a novel, flexible, highly efficient and scaleable system able to control the (European) cellular network resources during critical situations, e.g. earthquakes, new year's eve, public events, etc. In such a complex system, a resource management subsystem (RMU) is included, which receives from other monitoring units the alarm messages which are generated as a consequence of deviations from the nominal behavior of internal and/or external entities, and performs a decision-making process to react to the signaled alarm(s). The RMU component is the instantiation of the dependability-manager discussed above in the CAUTION++ framework. We intend to equip the decision-making process performed by the RMU with a model-based quantitative analysis, to better calibrate the reaction to the specific alarm situation and to optimize resource assignment.

References

[1] S. Porcarelli, F. Di Giandomenico, A.Chohra, A. Bondavalli, "Tuning of database audits to improve scheduled maintenance in communication systems", in Proc. of the 20th International Conference SAFECOMP 2001, Budapest, Hungary, pp. 238-248. Lecture Notes in Computer Science 2187. Springer, 2001.

[2] A. Chohra, F. Di Giandomenico, S. Porcarelli, A. Bondavalli, "Towards optimal database maintenance in wireless communication systems" in Proc. World Multiconference on Systemics, Cybernetics and Informatics, Vol. I Information Systems Development, Florida, USA , pp. 571-576, July 2001.

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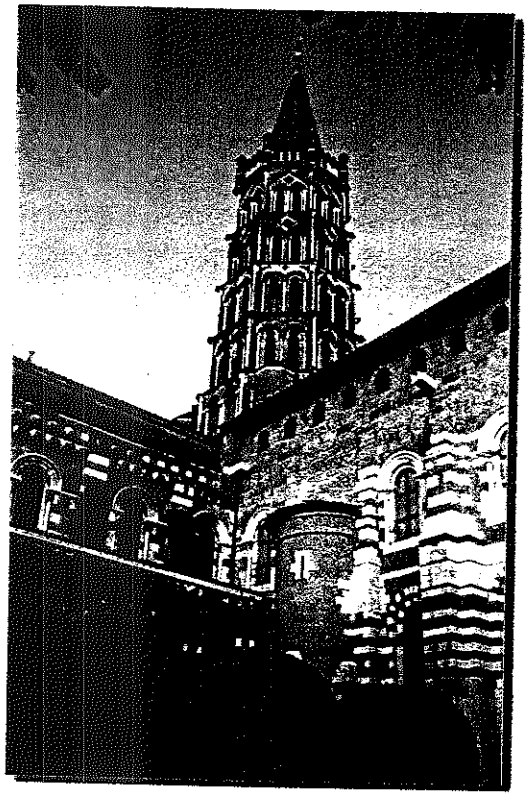

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