A Power System Java-based distributed database design

D. Menniti N. Sorrentino B. Giorgi
Department of Electronic, Computer and Systems Science
University of Calabria
Via Pietro Bucci, Cubo 4C
87036 Rende-Italy

Abstract - The great bulk of data that characterises the EMS/DMS supervisor monitoring or control actions comports noteworthy system information management problems. It is important to adopt a new modelling philosophy that allows in a simple but efficient manner the system state representation within an open architecture environment. In this paper, the Power System is represented through a distributed database, using the Big Object Modelling (BOM) technique to model each of its components, that allows a quick and wide access to all system information.

Keywords: Distribution Management System (DMS), Energy Management System (EMS), Object Oriented Analysis, Big Object Modelling, Java, Java Database Connectivity, Distributed Database, Database Management System

I. INTRODUCTION

In power system management, where it is desirable to meet an information complete and wide access, the adoption of an "open" and "distributed" architecture is of primary importance. In order to recovery and publish system data deriving from the all over distributed applications making it available for control actions and further elaboration in the control centers, an opportune data model is needed.

In the paper the authors' aim is to design a distributed database architecture for EMS/DMS control center, so to obtain a reliable and quick means for the complete supervision and control of the power system.

II. POWER SYSTEM OBJECT ORIENTED DISTRIBUTED DATA MODEL

In designing software applications for power system, this one can be represented by a large and distributed database by means of which all system elements communicate, thus providing an integrated and distributed control system environment.

Applying the Big Object Modelling methodology, each *subsystem* (power system element) can be represented as a big and complex object (*BOStatus*), where all its state related data and changes information are stored. The *BOStatus* results from the aggregation of many component objects (BOCs), each of them representing a particular Intelligent Electronic Devices (IEDs) operating in the *subsystem*. The *BOStatus* is therefore the repository where all system information arrives and is maintained. The IEDs, wherever they are located, work as *clients* of the *BOStatus*.

In order to realise a higher level application the complete knowledge over the system is necessary. For this reason it is needed to couple to each local *BOStatus* a database, named "*BOStudy*". This one is a slightly different version of the *BOStatus* and occurs in contexts such as planning. The *BOStudy* can be represented as a script of events, deriving the data source from the current dynamic data model (*BOStatus*) each time an event arrives.

This sheme poses an important problem of integrating the databases, distributed in the system, so to appear as a unique EMS database. In such a way it is easy to guarantee a supervisor level of the system and to integrate local and global control action in a very transparent manner.

In particular, it is useful to take advantage of the main Java properties: portability and distributed object oriented databases management. Utilising JDBC (Java Database Connectivity), it is possible to support complex queries on EMS/DMS databases distributed, allowing interoperability among different operating systems and machines.

III. AN EXAMPLE OF HIERARCHICAL FUNCTION

In order to show its effectiveness a possible EMS hierarchical function has been implemented. In particular, the load shedding problem is considered. It is well known that when a dangerous contingency occurs, in some cases, in order to avoid system collapse, a certain amount of load has to be shed. In this paper a *two level control system*, easily implemented by the proposed scheme, is proposed.

The *first level* is a control center centralised decision based on the knowledge of the actual load level requested by the nodes. When a contingency occurs an optimisation procedure determines where and how many loads it has to shed. The *second level* is a substation local decision: in consequence of the total amount of load to be shed communicated by the first level, it determines local loads to shed.

IV. CONCLUSION

The paper dealt with developing a vendor independent object data model. Accounting with this aim the paper system has been represented using both a dynamical (*BOStatus*) and a static (*BOStudy*) view. The *BOStatus* can perform data distribution at the performance level mandated by the most real-time data acquisistion system. The *BOStudy* has been used for data sorage and sharing within EMS-DMS environment.

V BIOGRAPHIES

Bruno Giorgi (MS PHD) was born in S.Luca (RC), Italy, on January 19, 1971. He is a member of the Electric Power Group at University of Calabria, Italy.

Daniele Menniti (MS PHD) was born in Susa(TO), Italy on September 23, 1958. He is a Associate Professor in Electrical Power Systems at University of Calabria, Italy.

Nicola Sorrentino (MS PHD) was born in Cosenza, Italy, on October 26, 1970. He is a member of the Electric Power Group at University of Calabria, Italy.