ABSTRACT

The main objective of this research is to develop enhanced models for on-line power system analysis in a distributed and platform independent environment. Distributed models for power system applications have been implemented using RMI, CORBA and .NET Remoting technologies. The interoperability among the heterogeneous power system clients in a distributed environment has been achieved through XMLisation of power system data which provides meaningful solution to the legacy issues associated with power systems.

An RMI based model for load flow monitoring in a distributed environment had been implemented and discussed in detail. A customized registry is created to bind the remote load flow server object and hence the resource consumed by the default RMI registry is released. A dynamic stub loading procedure is adopted to enable the power system client to obtain the remote server object's reference. A callback mechanism has been developed to automate the load flow monitoring at specific intervals of time. RMI based group communication and active network models have been designed and implemented to enhance the scalability of power system applications in a distributed environment. All these models deviate from the default behavior of RMI protocol which is always supporting unicast and hence inter-remote object communication has been achieved and thus reducing the computational time in solving power system applications in distributed environment. A component model for on-line power system analysis has also been proposed and implemented to increase the reusability and scalability of the system.
A location transparent model has been developed using CORBA with RMI-IIOP for load flow monitoring and the idea is extended to solve on-line economic load dispatch and dynamic security analysis. The performance analysis of the proposed distributed models has been carried out with respect to load flow monitoring, dynamic security analysis and economic load dispatch. The variations of Round Trip Time with respect to the number of power system clients are plotted as graph. RMI based model with callback mechanism performs better than all other models.

A .NET remoting architectural model has been developed for on-line economic load dispatch in a distributed environment. Being a very flexible model it provides the capability to extend power system application by adding custom components and different versions of economic load dispatch logic components that are serviced without affecting the power system client. A mobile agent based on-line economic load dispatch model has also been implemented. This model is very effective in saving the network bandwidth and allows the Economic Load Dispatch agent to process the power system data in the client machine itself. The proposed agent model makes the economic load dispatch application as more fault tolerant where network failure can influence only the migration of an Economic Load Dispatch agent as the rest of the process is then done locally on the same node. Thus continuous service and monitoring of economic load dispatch solutions have been achieved.

This thesis explores various issues in deploying power system applications in a distributed environment. It will serve the purpose of stimulating interest among power engineers and also will be extremely useful for electric power utilities.