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**MICROCOMPUTER APPLICATIONS IN THE CONTROL
OF
TELEPHONE NETWORKS**

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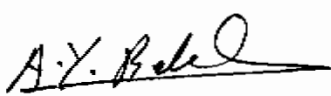
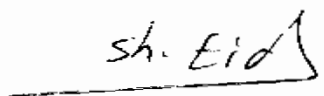
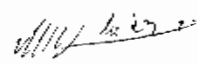
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Statement

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ABSTRACT

The design and implementation of a control center for an urban telephone network is necessary in order to centralize the maintenance, management and control process. This network is characterized by large size, complex topology and multistage routing patterns. In addition, the considered network has different types of switching system structures. Therefore, some problems will face the development of a model which integrates these tasks. The problems which result from the large network data size and their different structures are manipulated using a network division into disjoint subsets of control islands. Each island includes all switching systems with the same structure and controlled by a regional control center, while the problems which result from the large processing time are treated using a distributed processing system.

The hardware design of the distributed processing system takes into account the interfacing problems with the distributed islands, while the software package is developed to establish communication with the remote regional control center, poll traffic data, convert it into a standard format, evaluate the network state and produce a comprehensive management and maintenance reports.

The proposed management process has been executed for a hypothetical telephone network, using a simulation program, in which the hardware of each switching system is hierarchally structured to calculate the switching system state as well as the junction network state.

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CHAPTER 1

INTRODUCTION

1.1 General Outline

The considered telephone network includes different types of switching systems. The switching systems are classified according to the control techniques and the switching system structures. The control techniques for the switching systems are either direct, progressive or common controlled systems. The considered common control systems are divided into hard-wired, wired-logic or Stored Program Control (SPC) systems. The control architecture of the SPC systems may be centralized or distributed. In both cases, the control modules of the centralized part update their information with real time traffic, maintenance and management data. These control modules provide fully automatic data collection to perform various functions of call processing, call supervision and traffic analysis. The control modules also include programs for fault processing and diagnostics. In contrast to the SPC switching systems, the hard-wired and wired-logic systems need additional interfacing equipments for traffic data polling and analysis procedure.

For an urban telephone network with these different switching structures, large size, complex topology and multistage routing patterns, some problems will constrain the control process of the network.

The design and implementation of a distributed processing system for network control process has been achieved in this thesis taking into account the hardware configuration as well as the integrated software sub-packages.

The hardware configuration of the considered network has been described using an island strategy. This strategy divides the telephone network into islands, each one includes all the switching systems with the same structure and is controlled by a regional control center. These centers are linked with the distributed processing system through interface computers. These interface computers are networked with the central computer using a common bus configuration.

The integrated software sub-packages are designed for providing communication, command control process, data file transfer facility, data analysis and finally retrieving the traffic, maintenance and management reports for the whole network.

The system features relating to the network supervision, maintenance and management routines, for both the SPC systems and hard-wired systems, are presented in the next section. While section 1.3 presents the control strategies for both the disjoint islands and the overall network. The thesis objectives and contents are outlined in section 1.4 and section 1.5 respectively.

1.2 Switching Systems Control Features

The considered telephone network includes switching systems of different manufactures. These switching systems perform the same function, but they are entirely different in their structure, switching procedures, operation and maintenance procedures. This section presents the systems features relating to the operation, maintenance and management routines for both the SPC systems and the hard-wired common control systems.

1.2.1 Stored Program Control Systems

The SPC systems offer great advantages from the operational and maintenance point of view. It is designed with high reliability and flexibility. High reliability results from using solid state components with rapid operating speeds that permit a relatively small amount of modules to perform control function. This also results from its ability for automatic self diagnostic and testing capabilities of the entire switching system, as well as its ability to locate troubles outside the switching center. High flexibility results from its ability to support the large range of traffic requirements and modular growth without service interruption.

The hardware supplements and test programs for fault processing and diagnostic functions can individually test all the switching system modules such as central control modules, peripheral control modules, switching modules, signalling modules, line /trunk modules, and other redundant

modules in the system. Also, it provides preventive checking facilities, connected to all modules, such that faults can be detected before they affect the switching operations. Therefore, a series of measurements are automated with the aid of the central processor for fault detection, then according to the management policy, it can isolate, rearrange or reroute the traffic to redundant modules with programmable changeover facilities.

The SPC systems, from the operational point of view, have the ability to modify any service or system feature through software changes. These features provide subscriber management and switching center management. The subscriber management includes the subscriber line creation, suspension, isolation or modification. The exchange management functions include circuit & circuit group grading & creation, modification, isolation and provide test facilities to measure the state of these circuits [1],[2],[3].

Besides controlling the switching system operation, the SPC systems provide new facilities to collect a large amount of traffic data for real time management or post processing planning requirements.

1.2.2 Hard-wired Control Systems

The hard-wired control systems which are existing in the considered telephone network are built up with space switches working under the control of electro-mechanical markers and registers. The switching system contains a subscriber stage, one or several group of selector stages, and various units for controlling the call setup.

These systems have no processing facilities and need additional interface equipment, selected and installed to collect traffic and maintenance data. This equipment can simultaneously collect peg count and usage from all the switching system circuits according to the settings of the control functions . Each equipment can accommodate a maximum number of input leads to be monitored. The input leads may be programmed in groups, for example, sender group, line finder group, connector group, etc. [4].

2. For switching systems of large sizes, a number of interfacing equipment are required. In this case, a line multiplexer is added to multiplex all the data measuring equipment and to interface them to a poller, using a dedicated two wire line.

The poller can collect traffic and maintenance data manually or automatically according to internally stored polling command, polling schedules and polled telephone number table. The hardware configuration of this control systems is illustrated in fig.(1.1).

The poller can be connected directly to the network control center through a dial up or leased communication facility. The proposed interface computer initiates commands to the poller to collect traffic and maintenance data, which is adapted to the different types of commands. Traffic data consists of peg count and usage of individual lines or group of lines. Maintenance data gives the state of individual circuits or group of circuits [5].