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FACULTY OF ENGINEERING
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Fault Detection in Mobile Networks using Telecommunication Management Network (TMN)

A Thesis

Submitted in Partial Fulfillment for the Requirements
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(Electronics and Communications Engineering)

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Statement

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Electrical Engineering (Electronics and Communications Engineering).

The work included in this thesis was carried out by the author at the Electronics and Communications Engineering Department, Faculty of Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or qualification at other university or institution.

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ABSTRACT

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The telecommunications management network (TMN) provides a framework for achieving interconnectivity and communication across heterogeneous operating systems and telecommunications networks. TMN was developed by the International Telecommunications Union (ITU) as an infrastructure to support management and deployment of dynamic telecommunications services. The most important areas of network management identified by TMN are: Configuration Management, Fault Management and Performance Management. Fault management consists of fault detection, isolation and malfunction repair.

This thesis handles fault management, precisely fault detection and alarm correlation in the mobile networks, considering the supplier and the function of each network element and the performance of the network and the effect of network management on the network performance.

TMN, fault management have been simulated in a tool developed to generate a finite size log file of a simulated network, and then use alarm correlation and generate a new log file. Then comparing both and analyzing data to study and evaluate the performance of the network using different correlation rules on the generated alarms and assuming different suppliers for different network elements and stages.

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List of Abbreviations

3GPP IRP	3rd Generation Partnership Project Integration Refrence Point
ACSE	Association Control Service Element
ANSI	American National Standards Institute
ASN.1	Abstract Syntax Notation One (ASN1)
AUC	Authentication Center
BML	Business Management Layer
BSC	Base Station Controller
BTS	Base Transceiver Station
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
CORPA	Common Object Request Broker Architecture
DCF	Data Communication Function
DCN	Data Communication Network
ECIC	Electronic Communications Implementation Committee
EJB	Enterprise JavaBeans
EM	Element Manager
EMF	Element Management Function
EML	Element Management Layer
EpM	Enterprise management
EpMF	Enterprise Management Functi
eTOM	enhanced Telecom Operations Map
FCAPS	Fault, Configuration, Accounting, Performance, and Security
FMP	Fault Management Platform
GDMO	Guidelines for the Definition of Managed Objects
GGSN	Gateway GPRS Support Node
GMSC	GPRS Mobile Switching Center
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HCPN	hybrid circuit/packet networks
HCPN	hybrid circuit/packet networks
HLR	Home Location Register
HTTP	Hypertext Transfer Protocol
ICT	Information and Communications Technology
IRP	Integration Reference Point
ITU	International Telecommunication Union

ITU-T	ITU Telecommunication Standardization Sector
JMS	Java Message Service
LLA	Logical Layered Architecture
MCF	Message Communication Function
MD	Mediation Device
MF	Mediation Function
MIB	Management Information Base
M-part	Message Part
MPCMF	Market, Product and Customer Management Function
MSC	Mobile Switching Center
NE	Network Element
NEF	Network Element Function
NEL	Network Element Layer
NGN	Next Generation Networks
NGNM	Next Generation Networks Management
NM	Network Manager
NMF	Network Management Function
NML	Network Management Layer
NRM IRP's	Network Resource IRP's (Network Resources to be managed)
ODP	Open Distributed Processing
OEMF	OpenView Element Management Framework
OMC	Operation and Maintenance Center
OPS	Operations
OS	Operations System
OSF	Operations Systems Function
OSI	Open Systems Interconnection
OSS	Operation Support Systems
OSS/BSS	Operation Support Systems / Business Support Systems
PCM	Pulse-code modulation
PLMN	Public Land Mobile Network
P-part	Protocol Part
PSTN	Public Switched Telephone Network
QA	Q Adaptor
QAF	Q Adaptor Function
QOS	Quality Of Service
RAS	Reliability, Availability and Survivability
RF	Radio Frequency
ROSE	Remote Operations Service Element
SEF	Service Element Function
SEMF	Service Element Management Function

SIP	Strategy, Interface & Product
SLA	Service Level Agreement
SMF	Service Management Function
SMK	Shared Management Knowledge
SML	Service Management Layer
SNMF	Service Network Management Function
SNMP	Simple Network Management Protocol
SOA	Service-Oriented Architecture
SOAP	Service Oriented Architecture Protocol
SONET	Synchronous Optical Networking
SPRM	Supplier/Partner Relationship Management
SPRMF	Supplier/Partner Relationship Management Function
SRMF	Service Resource Management Function
SS7	Signaling System #7
TEF	Transport Element Function
TEMF	Transport Element Management Function
TMN	Telecommunication Management Network
TNMF	Transport Network Management Function
TRMF	Transport Resource Management Function
TRU	Transceiver Unit
UMTS	Universal Mobile Telecommunications System
VLR	Visitor Location Register
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WS	Work Station
WSF	WorkStation Function
XML	Extensible Markup Language

List of Symbols

F	Finite sample size.
N	Sum of probability of occurrence of all alarms.
CMSC	Count of MSCs.
CBSC	Count of BSCs.
CBTS	Count of BTSs.
N_{OCC}	Number of occurrence of each alarm.
P	Probability of occurrence