

APPLYING SIGNALING METRICS IN EVALUATING AND MODELING PSTN AND PLMN NETWORKS PERFORMANCE

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ

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LIST OF ABBREVIATION

A

AAL	ATM Adaptation Layer
ANSI	American National Standardization Institute
AMPS	American Mobile Paging System
ACM	Address Complete Message
ASR	Answer Seizure Ratio
ACSR	Average Call Seizure Rate
ANM	Answer Message
ACC	Address Complete to Calls ratio
AFCS	Average Failed Calls due to Subscribers
AFCN	Average Failed Calls due to Network
ALOC	Average Length Of Conversation
ACP	Assignment Complete message
AIN	Advanced Intelligent Network
ARQ	Assignment Request
ACP	Assignment Complete

B

BHPT	Busy Hour Peak Traffic
BHCA	Busy Hour Call Attempt
BSS	Base Station Subsystem
BSC	Base Station Controller
BSSAP	BSS Application Part
BSSMAP	BSS Mobile Application Part

C

CCS	Centum Call Seconds
CPS	Calls per Second
CC	Call Control
CMC	Cipher Mode Command message
CR	Connection Request message
CLU	Class mark Update message
CMCP	Cipher Mode complete message
CLR	Clear message
CCP	Clear Complete message
CAP	CAMEL Application Part
CAMEL	Customized Application Mobile Enhanced Logic
CDMA	Code Division Multiple Access

CRNC	Controlling Radio Network Controller
CIC	Circuit Identification Code
CS-1	Capability Set
D	
DTAP	Direct Transfer Application Part
DPP	Daily Peak Period
DPC	Destination Point Code
DAMPS	Digital Advanced Mobile Phone System
E	
EDGE	Enhanced Data for GSM Evolution
ETSI	European Telecommunications Standards Institute
F	
FDMI	Fixed Daily Measurement Interval
G	
GoS	Grade of Service
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Services\
H	
HDRE	Handover Required Message
HDCP	Handover Complete Message
HSCSD	High Speed Circuit Switching Data
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
HSS	Home Subscriber Server
I	
ITU	International Telecommunications Union
ISUP	ISDN User Part
INAP	Intelligent Network Application Part
IN	Intelligent Network
IMSI	International Mobile Subscriber Identity

IP	Internet Protocol
IETF	Internet Engineering Task Forces
ISDN	Integrated Services Digital Network
IMT	International Mobile Telecommunications
IMS	IP Multimedia Subsystem
IMEI	International Mobile Equipment Identifier
IMPI	IP multimedia Private Identity
IMPU	IP multimedia Public Identity
IAM	Initiation Address Message
IDR	Identity Request message
IR	Identity Response message

K

KPI	Key Performance Indicator
-----	---------------------------

L

LCD	Lost Calls Delayed
LCC	Lost Calls Cleared
LCR	Lost Calls Retried
LCH	Lost Calls Held
LAPD	Link Access Protocol for D-channel
LNP	Local Number Portability

L

M

MO	Mobile Originating
MT	Mobile Terminating
MTP	Message Transfer Part
MMS	Multimedia Message Service
MGCP	Media Gateway Control Protocol
MM	Mobility Management
MOS	Mean Opinion Score
MAP	Mobile Application part
MSC	Mobile Switching Centre
MSU	Message Signal Unit

N

NBAP	Node B Application Part
NSS	Network Subsystem
NGN	Next Generation Network
NADC	North America Digital Communications
NER	Network Effectiveness Ratio
NPM	Network Performance Metrics

O

OMC	Operation Management Centre
O&M	Operation and Maintenance
OPC	Originating Point Code
OSS	Operation Subsystem

P

PCM	Pulse Code Modulation
PLMN	Public Land Mobile Network
PSTN	Public Switching Telephone Network
POTS	Plain Old Telephone System
PHS	Personal Handy phone System (Japan)
PDC	Personal Digital Cellular (Japan)
POI	Point Of Interconnection

Q

QoS	Quality of Service
-----	--------------------

R

RFC	Request for Comments
RR	Radio Resources
RNC	Radio Network Controller
RF	Radio Frequency
REL	Release
RLC	Release Complete

S

SSN	Subsystem Number
SSP	Signaling Switch Point
SCCP	Signaling Connection Control Protocol
SCP	Signaling Control Point
SCTP	Stream Control Transmission Protocol
SIGTRAN	SIGnaling TRANsport protocol
SIP	Session Initiation Protocol
SGCP	Simple Gateway Control Protocol
SNR	Signal to Noise Ratio
SP	Signaling Point
SLF	Subscriber Location Function
SVC	Switched Virtual Circuit
SLA	Service Level Agreement
SMS	Short Message Service

T

TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
TCAP	Transaction Capability Application Protocol
TACS	Total Access Communications System
TMSI	Temporary Mobile Subscriber Identity

U

URI	Uniform Resources Indicator
URL	Uniform Resources Locator
UMTS	Universal Mobile Telecommunications System
USDC	United States Digital Communications
UPI	User Payload Identifier

V

VCI	Virtual Circuit Identifier
VPI	Virtual Path Identifier
VoIP	Voice over IP

W

W-CDMA	Wideband CDMA
W-LAN	Wireless Local Area Network

ABSTRACT

In this thesis, a method to analyze telecommunications networks performance on the basis of signaling networks parameters extraction has been introduced. Networks performance metrics are calculated from direct measurement of signaling parameters. The available measurements are divided into variable sets describing the performance of the different subsystems of the GSM and PSTN networks. The model parameters are estimated from the available data records using simple quantification methods. Simple mathematical models for the subsystems are proposed.

The parameter estimates are used to find the input-output variable pairs involved in the most severe performance degradations. Finally, the methodology is applied on two case studies, as a sample from PSTN and PLMN networks.

APPENDICES
