Research Article

Analysis On GSM Fault Management Unit

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Abstract

This report is on analysis on GSM fault management unit in operation and support system (Operation and maintenance centre) or OMC of GSM system. To obtain a reliable Telecommunication system which is free of various degree of faults. The integrated faults management unit that was design is a sub-section of the OMC known as operation and maintenance centre, the integrated faults management unit was design with various software such as Netcool Omnibus, AVAPM, Java script for managing of event collection and alarm correlation management. An alarms system was used to notify the operator of various degree of faults with their locations. Form the analysis carried out the unexpected tributary bit rate faults has the highest occurrence, 88.418 in a year. Follow by resource isolation, September and May transition failure 65.354 in a year. The highest number of faults occurrence, base on change of weather condition, from dry season to rain season in Nigeria.

Keywords: OSS, Operation and support system, OMC, Operation and maintenance centre, Netcool Omnibus, NE, Network element,

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1. Introduction

Since 1989, there has been enormous activate throughout the world to develop personal wireless systems that combine the network intelligence of today PSTN with modern digital signal processing and RF technology. From the user's perspective, the new generation will strive to ensure that current mobile services system are free from various degree of faults which are, loss of signal, battery failure, link identity code mismatch, low Bit Error Rate (BER), resource isolation, transmitting failure, Computer Power Unit (CPU) overloaded, E1 board crash, cable disconnected, application went down to enhance effect mobile communication.

The most important concepts is to develop wireless communication system that are problems or faults free. The desire, to realized this concepts gave room to the introduction of Operation and Support System (OSS) which is built along side with GSM System (Wireless Communication) Network. The OSS is divided into sub groups known as operation and maintenance centre (OMC) and Network and management centre (NMC). They are connected to the BTS, BSS, MSC through an interface known as Q-interface for signaling purpose [3].

1.1 The Operation And Support System (Oss)

The operation and support system is made-up of two levels management functions that provide centralized control of the network. They are:

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1. Network and maintenance centre (NMC) staff can concentrate on long term planning from activities carried –out from the NMC.

2. Operation and maintenance centre (OMC): concentrate on short-term regional issues (Rappaport; *2003*).
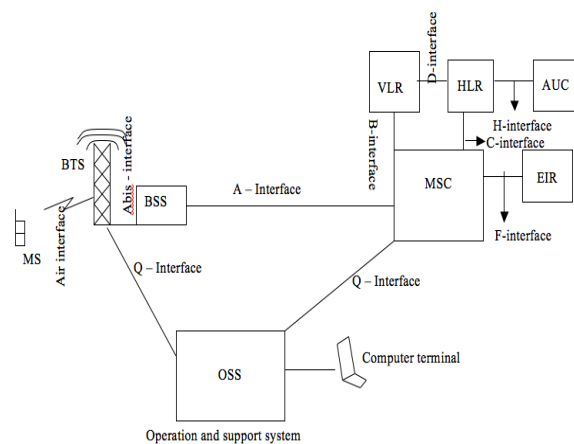
Fig. 1. Overview of GSM Network

An OMC is a computerize monitoring centre which is connected to other network components such as MSCs and BSCs via X.25 data network link or SS7. In the OMC, staff are presented with information about the status of the network and can monitor and control a variety of system parameters. There may be one or several OMCs within a network depending on the network size [1],[2].
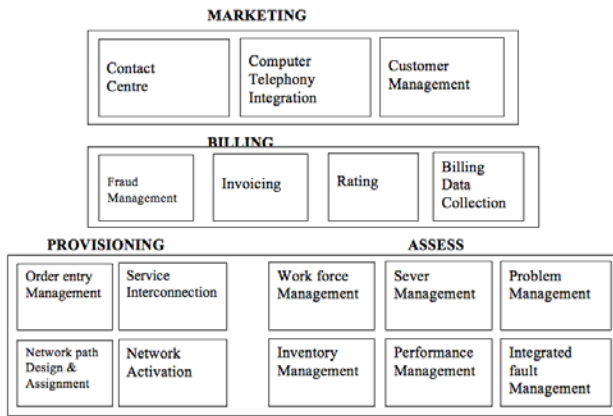
Fig. 2. The Architecture of OSS (Operation and Support System) profile.
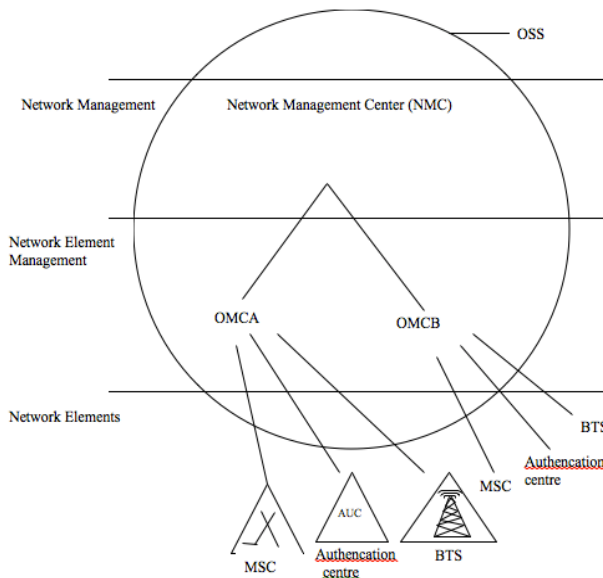

Fig. 3. Network Management Centre and Operation and Maintenance Centre (NMC and OMC)

2. Methodology

The integrated fault management unit was designed base on suitable software such as netcool ommbus, java etc. integrated fault management unit is a part of the operation and support system application (OSS). The netcool omnibus software is responsible for managing three important functions in the integrated fault management unit. The functions are collection of faults in the entire network, identification of faults location, alarm centralization management. The various faults can be rapair remotely from various operation and maintenance centre or by moving to exact fault location site to effect repair on the network. The principle of operation shown in integrated fault management block in fig 2.1. Data collected were from the integrated fault management unit for duration of one year January to December.
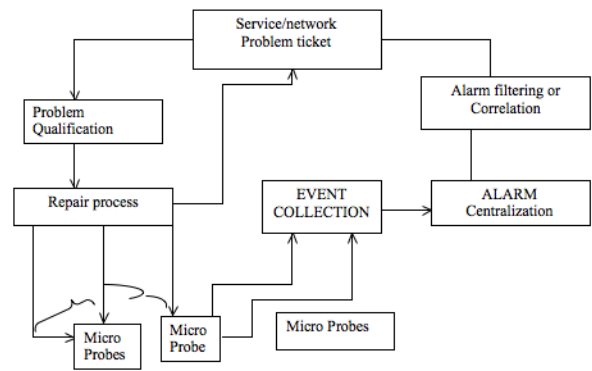

Fig. 4. Stages of alarm and fault treatment block diagram

3. Overview Of Integrated Fault Management Unit

The integrated fault management centre are responsible for events or faults collection, alarm centralization which is responsible for network alarm status presentation, alarm status viewer, alarm data storage, alarm monitoring, alarm display, alarm handling, telnet session and network map management.

Event Collection Unit
From the diagram above, the event collection unit are responsible for collection of various fault activities, are base on the operation of netcool omnibus software and other relative software. The faults are collected with the aid of micro-probles, which notify the operators of various degrees of faults. The integrated fault management unit has the ability to correlate various types of faults that affect continuity in the GSM network system. The output results are sent to alarm centralization for further processing.

Network Alarm Status Presentation or Alarm Status Viewer
A common network operator task is to supervise the network alarm status and to act upon incoming alarms. All alarms, from BTS, BSC, and MSC faults such are external fire, water, intruder etc. All alarm fault indicator are routed to integrated fault unit (Alarm centralization). For necessary action.

There are alarm severities and operators defined parameters, an alarm bell is activated. It is also possible to filter alarms so that only certain alarms are presented. The alarms are presented on a graphical map of the operating area, called Network Status Presentation (NSP). The alarms are displayed next to the affected Network Element. Different symbols are used to depict different alarm-categories:

Alarm severity	when to take action
Critical	Action must be taken immediately
Major	Action must be taken as soon as possible
Minor	Action should be taken when there is time, or the situation should be observed
Warning	Take corrective action during routine maintenance

Indeterminate   An alarm has been generated for which there is no alarm severity defined in the system.

3.1 Alarm filtering or correlation or Alarm handling

Alarm correlation unit is all-inclusive name of the different alarm-handling functions (Alarm Handling). The primary features of Alarm Handling. Events reported from Network Elements (NE), as well as datalink faults, the external alarms and Operation and support system (OSS) internal errors are processed and distributed to the following end-user services:

- Alarm Viewer
- Alarm Status Viewer

The user can view the alarms with the Alarm Viewer, which consists of three applications with graphical user interfaces: the alarm List Viewer, the Alarm Log Browser and the Alarm Status Matrix. Commands for searching alarms are also available.

- With Alarm List Viewer, the user can view details of the current alarms, and also handle these alarms.
- With the Alarm Log Browser, the user can search for specific alarms in the alarm log and view details and statistics of these alarms.
- With the Alarm Status Matrix, the user cans overview the current alarm situation in the network in a compressed view. Alarm Status Viewer.
- The Alarm Status Viewer presents the current alarm in the geographical and Logical Network Information Presentation (GNIP) framework, which provides both maps showing each supervised object at its geographical position and views showing the logical relation between supervised objects.
- The Alarm Viewer and the Alarm Status Viewers can also be displayed by a Windows NT workstation, but the main process is still executed in the Unix server.
- The routing of alarm messages to different output devices is also provided.
- An important feature of Alarm Handling is the capability of other Operations and Support Systems to subscribes to specific alarms handled by Operation and support system (OSS).

Alarm Handling has features for:

- Mapping of alarms to a normalized alarm-record format
- Indication of equipment within the Network Element (NE)
- Surveillance of the alarms heartbeat signal
- Surveillance of the datalinks used for communication with the network Elements NE's

When recovery has been achieved from a heartbeat or datalink failure, it is possible to perform alarm synchronization by updating the Alarm List through a new collection of alarm lists from the affected Network Element (NE) [2],[3].

3.2 Integrated Faults Management Features

The IFM features consist of the follow sub-system they are;

1. ALARM DATA STORAGE

Create the alarm generated by the Event Management Services and/or external applications in the fault management system database.

2. ALARM MONITORING

a. Build filter: create the alarm generated by the EMS and/or external application in the fault management system database
b. Build View: Set the alarm display format

3. ALARM DISPLAY

a. Monitor Box: Provide network alarm summering
b. Event list: Display the alarms in table format

4. ALARM HANDLING

a. Setting priority: Modify the alarm severity. Clear (green)/indeterminate (purple)/warning/minor. Major (yellow). Critical (red).
b. Acknowledgement and De-acknowledgment
c. Assignment: This function allows assigning alarm to specific operator
d. Deletion
e. Annotation: Adding additional information in the alarm.

5. TELNET SESSION: Enable the user to watch a telnet session.

6. NETWORK MAP MANAGEMENT

It creates the ability to locate the exact position of fault in the network geographical location.

The table 1 show various types of faults obtain in the telecommunication industries in Nigeria, total of 27 (twenty seven) faults was examine. The average fault report for each month from January to December for a year was also recorded.
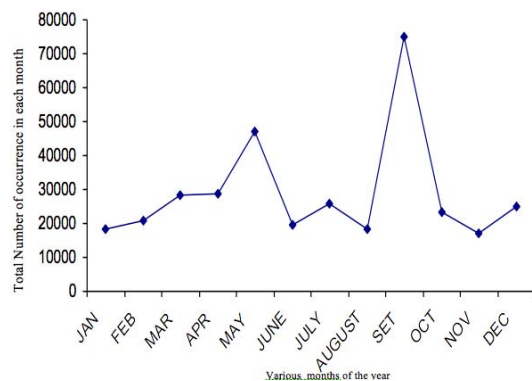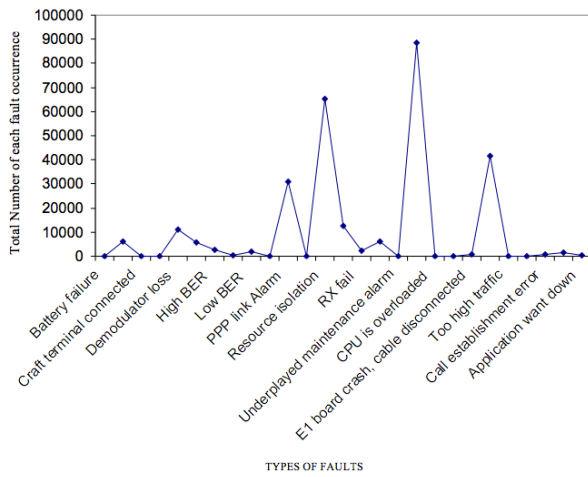

Fig. 5. Total number of fault Occurrence in each month

From the above fig 5 the total number of faults occurrence in each months was shown, May and September has the highest faults occurrence due to change of weather from dry season to raining season in Nigeria resulting to short circuit, open circuit, resource isolation etc.

Fig. 6. Total Number of occurrence per each faults

From the above Fig. 6 shown difference types of faults that occur in GSM system in Nigeria. From the analysis carries out the unexpected tributary bit rate fault has the highest occurrence at 88.418.

Conclusions

The integrated fault management unit was design, using various softwares such as netcool Omibus, Java scrip etc, and sub-section of integrate fault management unit known as Network alarm status presentation help to notify the GSM operators of various degree of faults and their respective locations on the network. Such degrees are called alarm severity, classified into critical-red, major-yellow, minor or warning-purple and indeterminate-green. In addition there are alarm viewer and alarm status viewer, which are in built in the integrated fault management unit.

From the analysis in fig 6 it shows that unexpected tributary bit rate faults have the highest occurrences from all obtainable faults and effect should be made to reduce these particular fault. Follow by resource isolation fault. This can be due to man-made fault, system failure etc.

From figure 5 shown that, the month of May and September has the highest number of faults occurrence. These may result from, the change in weather condition in Nigeria, from dry-season to raining-season.

Table 1.   The Average Faults Report In Each Months

N/S	TYPES OF FAULTS	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL NUBER OF EACH FAULTS
1	Battery failure	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Loss of signal	176	389	407	357	306	399	561	282	403	382	430	302	5,984
3	Craft terminal connected	2	13	1	4	8	2	3	8	10	4	6	2	63
4	Delayed maintenance alarm	17	6	2	1	3	3	2	12	8	2	6	3	65
5	Demodulator loss	945	841	918	718	890	865	1,618	940	728	898	912	904	11,177
6	Early warming indicator	585	306	545	565	217	567	599	321	511	337	514	604	5,669
7	High BER	317	172	96	238	137	193	562	192	272	304	119	197	2,799
8	Link identity code mismatch	88	50	22	50	672	12	9	72	25	37	42	62	536
9	Low BER	242	121	42	326	149	243	293	57	49	131	212	164	2,029
10	Output power problem	0	1	1	0	1	1	0	0	0	0	1	0	5
11	PPP link Alarm	1,672	2,629	3,004	3,439	3,267	2,407	2,691	1,947	2,310	3,192	2,402	1,894	30,854
12	Prorogation alarm	4	41	4	11	18	13	60	8	6	14	6	4	189
13	Resource isolation	3,264	6,019	5,795	5,696	6,036	5,806	6,014	5,626	5,112	6,132	4,723	5,131	65,354
14	RX Ais insertion indication	1,753	884	503	1,400	660	660	2,184	696	906	1,107	1,237	604	12,594
15	RX fail	1	282	511	217	945	3	14	7	103	178	201	12	2,474
16	TX Ais insertion indication	164	363	946	810	453	674	541	213	378	419	672	511	6,144
17	Underplayed maintenance alarm	16	2	2	1	3	3	2	1	1	2	2	3	38
18	Unexpected tributary bit rate	2,956	5,885	10,609	11,988	10,266	5,088	6,621	5,214	10,817	5,661	3,189	10,124	88,418
19	CPU is overloaded	19	13	25	6	2	1	22	16	12	1	9	18	144
20	Disk is full	0	0	7	0	0	0	0	0	0	1	0	0	8
21	E$_1$ board crash, cable disconnected	13	69	161	52	19	5	75	47	89	6	21	97	654
22	Linkset or destination unavailable or NY network P	6,070	2,680	4,328	2,647	3,535	2,456	3,906	2,417	3,137	4,102	2,160	4,017	41,455
23	Too high traffic	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Underly resource unavailable	14	0	2	66	1	66	1	17	1	0	13	10	131
25	Call establishment error	47	75	104	62	12	26	74	82	22	71	48	15	638
26	Response time excessive	79	98	70	160	506	208	181	87	103	213	71	95	1,571
27	Application want down	47	5	59	37	29	4	4	49	6	30	7	46	323
	Total number of faults per each months	18,489	20,944	28,164	28,815	27,230	19,645	26,036	18,310	25,009	23,224	17,003	24,881	

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