Analysis and Finding a Solution for Remote Switching Unit Failures to Enhance the Service Quality of a Telecommunication Company

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ABSTRACT

This company is a well reputed leader in the telecommunication arena of Sri Lanka which can stands with both feet firmly planted on its exciting and promising road to tomorrow. This study and the data analysis were conducted while obtaining a sound training at Switching Section, in this company. The main part of the training was based on study of Remote Switching Units failures by gathering necessary information and analyzing the data. At the end, a reasonable solution with the use of Short Message Service (SMS) could be forwarded in order to solve this problem.

KEYWORDS: Remote Switching Unit, Master Switching Unit, Short Message Service (SMS) sending transceiver

INTRODUCTION

In this company there are Master Switching Units (MSUs). A single Master Switching Unit may consist of several Remote Switching Units (RSUs). The Remote Switching Units are responsible for handling the telephone calls of that area.

Remote Switching Units (RSUs) mainly depend on the commercial power supply or on the battery bank inside the RSU. Even a battery bank is present; it can supply power to the RSU for about twenty four hours when there is no commercial power.

When a Remote Switching Unit is failed due to power failure, it can be detected by an alarm at the Master Switching Unit (MSU). Then, the technical staff of the MSU can respond to the alarms at the day time. But at the night, the alarm detection process is transferred to the head office due to non availability of technical staff at the MSU. Therefore at nights, if there is a power failure, it will recognized by the staff of the head office and then they inform to the appropriate technical staff. This is not a direct way of identifying the failure of the RSU by the technical staff.

The existing system will take some time to inform the matter to the technical staff. This can badly affects the company name and the subscriber can face a difficult situation. If there is some method to detect the failure directly, it will help to correct it as soon as possible.

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LITERATURE

Telecommunication exchange

In a small business-type telephone exchange, calls are set up in TDM manner using PCM to convey speech and data if the exchange serves any data terminals. The exchange has subscriber line ports (SLC) each serving two lines and a smaller number of trunk line ports (TLC) each serving a trunk to a local exchange. Each port has a local processor (SIP) with analogue-digital and digital to analogue conversion circuitry (CODEC-FILTER-TSAC). The exchange also has a central processor (CP) with its associated memories (ROM, RAM, EAROM).

The ports and the central processor are interconnected by an intelligent bus (PCM BUS) and a signalling bus (SIG BUS). The central processor (CP) and the port processors co-operate in call setting with all communications between the processors over the signalling bus. During operation the central processor (CP) polls the ports via the signalling bus (SIG BUS) which need the services of the central processor and also to pass call control information to those ports.

To set up a call between the lines, or a line and a trunk, two time slots in the TDM cycle are allocated to the call by the central processor, one for each direction of transmission. The intelligence bus (PCM BUS) is thus used only to convey intelligence, i.e. speech and/or data and tones.

METHODOLOGY

Data Collection Strategy with a Rationale

When identifying the reasons to fail a Remote Switching Unit (RSU), it is very important to search the previous records related to failures of them. Among the previous records, there are different behaviors and reasons to fail a Remote Switching Unit. When mentioning the failures of Remote Switching Units it is necessary to consider the background of the failures and the locations. So that the following factors are considered.

- Location (The name of the failed Remote Switching Unit)
- Fault occurred due to (Switching/Transmission/Power)
- Fault reported (The date and time)
- Fault cleared (The date and time)
- Total outage hour
- Number of customers effected due to outage

The data is collected according to the above mentioned headings.

Design and Development of Data Collection Tools

Basically the following Table 1 is used as the main data collecting tool.

Location

The Remote Switching Units (RSU) of a Master Switching Unit (MSU) area are spread in various places. Normally a Remote Switching Unit is identified by the name of its located place.

Reasons for faults

In this section it considers about the reason why the Remote Switching Unit (RSU) is failed. In most of the times failure of a RSU occurs due to three main reasons. They are as follows.

Switch;

Remote Switching Unit can fail due to malfunctions of the electronic equipments inside it. Such a situation considered as switch.

Transmission;

There are E1s or connecting links between Remote Switching Units (RSU) and appropriate Master Switching Units (MSU) to connect the both. Normally micro wave links or fiber optic cables are used as these links and there are separate electronic equipments to carry out the transmission process. Failure of this link or electronic equipments can fail a RSU. Such .faulty conditions are taken in to account here

Power;

Power supplied to a Remote Switching Unit is using commercial power supply. Other than that there are battery banks to supply power. And also the generators are available in some Remote Switching Units. These power failures are considered under this topic.

Reported Faults

This data helps to find out when failure occurred as well as partial requirement to decide the total outage time of the Remote Switching Unit (RSU)

Faults

As mentioned above this data also required as a partial requirement to decide the total outage time of the Remote Switching Unit (RSU)

Total outage hour

This is calculated by considering the fault reported time and fault cleared time.

Number of customers affected due to outage

This shows how much subscribers are connected to Remote Switching Unit (RSU) and affected because of outage.

Location(Failed RSU Name)	Fault Occurred Due to (SW/Tx/Power)	Fault Reported		Fault Cleared		Total Outage Hours	Number of Customers Affected Due to Outage
		Date	Time	Date	Time		

Table 1: Data Collection Tool

DATA COLLECTION AND ANALYSIS

Data Analysis Strategy with Rationale

As mentioned earlier, the main reasons to fail a Remote Switching Unit are failure of switch, transmission and power. So the fifty data records are classified in to three sections according to the type of RSU failure.

Then it can get the sum of total outage hours and total amount of customers affected due to outage for each section.

Then the same way it can get the sum of total outage hours and total amount of customers affected due to outage for whole fifty data.

With considering the above mention two situations, it can calculate the percentage values for both the total outage hours and amount of customers affected due to outage.

This percentage values will help to give an idea up to what extend the three reasons, switch, transmission and power are caused to fail the Remote Switching Unit.

Percentage values of service outage hours and the number of customers affected

X - Sum of total outage hours (Due to power failures) =89

Y - Sum of customer affections due to outage (Outage is only due to power failures) =9771

M - Sum of total outage hours (Due to transmission failures) =168.84

N - Sum of customers effected due to outage (Outage is only due to transmission failures) =51364

R - Sum of total outage hours (Due to switching failures) =35.45

S - Sum of customers effected due to outage (Outage is only due to switching failures) =6938

P - Sum of total outage hours =293.29

Q - Sum of customers, effected due to Outage =68073

By considering the table 2, it can be calculated the percentage service outage hours (Only due to power failures) in the year 2007 and 2008.

$$\frac{\text{Sum of total outage hours (Due to power failures)} \times 100}{\text{Sum of total outage hours}}$$

$(X/P) \times 100$
$= (89/293.29) \times 100$
$= 30.345\ \%$

By considering the table 2, it can be calculated the percentage values of customers affected due to outage (Only due to power failures) in the year 2007 and 2008.

$$\frac{\text{Sum of customers effected due to outage (Outage is only due to power failures)} \times 100}{\text{Sum of customers effected due to outage}}$$

$= (Y/Q) \times 100$
$= (9771/68073) \times 100$
$= 14.353\ \%$

By considering the table 2, the percentage service outage hours can be calculated (Only due to transmission failures) in the year 2007 and 2008.

$$\frac{\text{Sum of total outage hours (Due to transmission failures)}}{\text{Sum of total outage hours}} \times 100$$

$= (M/P) \times 100$
$= (168.84/293.29) \times 100$
$= 57.567\ \%$

By considering the table 2, percentage values of customers affected due to outage (Only due to transmission failures) in the year 2007 and 2008 can be calculated

$$\frac{\text{Sum of customers effected due to outage (Outage is only due to transmission failures)} \times 100}{\text{Sum of customers effected due to outage}}$$

$= (N/Q) \times 100$
$= (51364/68073) \times 100$
$= 75.454\ \%$

The percentage values of service outage hours and customer affected (Only due to switching failures) in the year 2007 and 2008, can calculate as follows.

Percentage of service outage hours (Due to switching failures)

$= 100 - (30.345+57.567)$

$= 12.088\ \%$

Percentage value of customers effected (Due to switching failures)

$= 100 - (14.353+75.454)$

$= 10.193\ \%$

Location(Failed RSU Name)	Fault Occurred Due to(SW/Tx/ Power)	Fault Reported		Fault Cleared		Total Outage Hours	Number of Customers Effected Due to Outage
		Date	Time	Date	Time		
Dunagaha	Power	2/8/2007	15.05	2/8/2007	16.15	1.1	80
Lunuwila	Power	31/7/2007	07.30	31/7/2007	09.45	2.15	110
Badalgama	Power	10/8/2007	12.20	10/8/2007	15.34	3.15	697
Dankotuwa	Tx	9/8/2007	00.33	9/8/2007	13.15	12.42	2705
Kochchikade	Power	5/9/2007	10.00	5/9/2007	14.00	4	128
Badalgama	Tx	12/9/2007	00.08	12/9/2007	11.26	11.15	699
Badalgama	Tx	13/9/2007	23.04	14/9/2007	01.35	2.5	699
Dunagaha	Tx	13/9/2007	00.10	14/9/2007	11.15	11	1037
Sandalankawa	Tx	13/9/2007	00.10	14/9/2007	11.15	11	2747
Lunuwila	Power	13/9/2007	08.00	13/9/2007	14.30	6.5	200
Kochchikade	Power	27/10/2007	07.00	27/10/2007	10.00	3	128
Badalgama	Tx	7/11/2007	05.42	7/11/2007	11.32	5.45	702
Badalgama	Tx	9/11/2007	00.00	9/11/2007	04.38	4.38	702
Badalgama	Tx	9/11/2007	23.00	10/11/2007	01.45	2.45	702
Dankotuwa	Tx	9/11/2007	23.00	10/11/2007	01.45	2.45	2694
Kochchikade	Tx	9/11/2007	00.00	9/11/2007	04.38	4.38	3659
Kochchikade	Tx	9/11/2007	23.00	10/11/2007	01.45	2.45	3659
Dunagaha	Tx	9/11/2007	00.00	9/11/2007	04.38	4.38	2752
Dunagaha	Tx	9/11/2007	23 00	10/11/2007	01.45	2.45	2752
Sandalankawa	Tx	9/11/2007	00.00	9/11/2007	04.38	4.38	1040
Sandalankawa	Tx	9/11/2007	23.00	10/11/2007	01.45	2.45	1040
Sandalankawa	Tx	11/11/2007	05.00	11/11/2007	11.30	6.3	1040
Lunuwila	Tx	9/11/2007	23.00	10/11/2007	01.45	2.45	5091
Dankotuwa	Tx	8/2/2008	09.00	8/2/2008	10.00	1	250
Minuwangoda	Power	15/3/2008	18.50	15/3/2008	20.32	1.4	512
Dunagaha	Power	13/3/2008	24.00	14/3/2008	09.00	9	2726
Badalgama	SW	22/3/2008	09.45	22/3/2008	12.00	2	122
Dunagaha	SW	21/3/2008	14.30	21/3/2008	17.30	3	2726
Sandalankawa	SW	18/3/2008	08.30	18/3/2008	11.00	2.5	30
Kochchikade	Power	30/3/2008	22.15	31/3/208	09.30	11.15	128
Dankotuwa	Tx	18/4/2008	22.30	19/4/2008	17.00	18.5	2680
Dunagaha	Tx	18/4/2008	22.30	19/4/2008	08.00	9.5	2726
Lunuwila	Tx	18/4/2008	22.30	19/4/2008	16.30	18	5046
Katana	Power	24/5/2008	01.03	24/5/2008	07.08	6	512
Minuwangoda	SW	7/6/2008	07.00	7/6/2008	12.30	5.5	2048
Dunagaha	SW	7/6/2008	01.00	7/6/2008	23.00	22	1500
Kochchikade	Power	16/6/2008	08.30	16/6/2008	09.30	1	120
Katana	Power	18/10/2008	18.15	18/10/2008	20.15	2	1620
Katana	Power	18/10/2008	20.15	18/10/2008	22.45	2.30	256
Katana	Power	19/10/2008	10.15	19/10/2008	10.48	0.30	256
Katana	Tx	23/10/2008	04.30	23/10/2008	05.00	0.30	1620
Katana	SW	24/10/2008	06.45	24/10/2008	07.30	0.45	512
Katana	Power	24/10/20008	18.30	24/10/2008	20.45	2.15	128
Katana	Power	25/10/2008	07.15	25/10/2008	07.45	0.30	1620
Dankotuwa	Tx	30/11/2008	22.00	1/12/2008	01.00	3	4955
Lunuwila	Tx	30/11/2008	22.00	1/12/2008	13.00	15	2678
Lunuwila	Power	13/12/2008	09.30	13/12/2008	11.30	2	150
Sandalankawa	Power	25/8/2008	04.00	25/8/2008	10.00	6	200
Sandalankawa	Tx	30/8/2008	23.00	31/8/2008	10.30	11.5	100
Sandalankawa	Power	7/9/2008	07.30	8/9/2008	09.00	25.5	200

Table 2: Service Outage Report

The table 2 shows the details about the failures of Remote Switching Units (RSUs) of Katunayake and Negombo Master Switching Unit (MSU) area. This randomly selected data are related to the years 2007 and 2008

RESULTS AND DISCUSSION

	Percentage value of Total outage hours	Percentage value of Customers affected
RSU fail due to power failure	30.345 %	14.353%
RSU fail due to transmission failure	57.567 %	75.454%
RSU fail due to switch failure	12.088%	10.193%

Table 3: Final Results

DISCUSSION

Remote Switching Units can fail due to numerous reasons. Among them we can identify three major reasons as power, transmission and switch failures. Power failures happened due to commercial power failures. In rainy days power can cut off from the trip switch due to lightening. And transmission failures can happen due to malfunctions of transmission equipments and failures of fiber optic cables or microwave links. Switch failures occur mostly due to faults of subscriber cards. Sometimes the switch could not give the appropriate ring tones to subscribers.

Out of these three reasons, power failures are the major reason to Remote Switching Unit failures. Therefore as recommendation can send SMS Transceiver to let know about the power failure of Remote Switching Unit.

CONCLUSION

The analysis was conducted on the failures deal with the Remote Switching Units (RSU) of Katunayake and Negombo Master Switching Unit (MSU) areas. The studied Remote Switching Units of Katunayake area is Badalgama, Minuwangoda and Katana. The other

RSUs operating under Negombo MSU, namely Dunagaha, Lunuwila, Dankotuwa, Kochchikade, and Sandalankawa are also considered for this study. Fifty data sets in the years of 2007 and 2008 from the appropriate data records were considered. These data records were randomly selected. One half of data belongs to the year 2007 and the other half belongs to 200 As the results of the study, an efficient data analysis was done about the total outage hours of Remote Switching Units and the reasons for their failures were identified. As a result of calculating the percentage values, it can be shown that up to what extend those reasons contribute the failures of RSUs. At the same time it was able to get an idea about the customer affection due to the outages. (i.e. time duration for RSU related failures)

. The overall data analysis shows the nature of Remote Switching Unit failures and how it affects both the customers and the reputation of the company.

Therefore, in order to reduce the service outage hours, a solution was suggested for designing of a SMS sending transceiver to inform about the power failures to the responsible parties. It will speed up the Remote Switching Unit failure correction process. As the future work the designing of an electronic device with the use of software controlled microcontroller is suggested in order to automate the above faulty informing process.

REFERENCES

- Exchange Log book
- Previous outage reports