Mechanism of Accessing Base Station Remotely from OMC

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***Abstract* – This paper proposes the development of "Remote Access to Base Station" (RABS) tool at the Operations and Maintenance Center (OMC) side using which some commands can be sent to the Base Station (BS) remotely and relevant data can be retrieved about the status of the BS. The commands are sent using SNMP from OMC, which are processed at the BS and the output data files are uploaded back to the OMC from BS using TFTP. Hence, the technician or the operator do not have to be present in the base station site to take any data and check the issue occurred at the BS until and unless there is any major issue like requirement to replace the hardware. The operator can keep a check on the working of BS thereby reducing the loss due to travel time to the site to fix issues and cost incurred in that process by the service provider. Post development of RABS tool, various scenarios are identified and written in the form of test cases to validate the functionality of the tool to access the BS remotely.**

Keywords – Operation and Maintenance Center (OMC), Base Station (BS), Simple Network Management Protocol (SNMP), Trivial File Transfer Protocol (TFTP), Mobile Station (MS), Access Controller (AC), Standby Controller (SC), Base Radio (BR), Remote Access to Base Station (RABS).

I. INTRODUCTION

It was observed that at present remote access to BS is not directly available to the maintenance engineer in the 2G/2.5G systems which are still being used by ISPs. Most of the times, an engineer has to go to the Base Station installation to check for the preventive maintenance. Also, during emergency breakdowns it is difficult to bring up the network from remote access. This paper proposes an idea to achieve remote access, getting the data about the status of BS and smooth maintenance without affecting the end user.

The initial mobile networks of the mid-1980s, referred to as first generation (1G) networks, were based on analog signal communication. These networks have limited regional scope, mostly confined to national boundaries. The early 1990s saw the replacement of these analog networks with the digital second generation (2G) networks. Second-generation (2G) digital cellular systems constitute the majority of cellular communication infrastructures deployed today. In part they helped fuel the transition of a mobile phone from luxury to necessity and helped to drive subscriber costs down by more efficient utilization of air interface and volume deployment of infrastructure components and handsets [1].

A typical 2G system has a Mobile Station like Cell Phone, Base Station Subsystem (BSS) and Network Switching Subsystem (NSS). The network elements of BSS and NSS are controlled and configured by Operations and Maintenance Center (OMC). This paper deals with data retrieval from the BS, which is a component of BSS using OMC.

A MS is referred to the end user interface to the network. In this paper, MS considered is a mobile phone. The network element that helps the MS to connect to the core network and further is the BS. The BSs are located in the cell sites. A BS contains two main units in itself – the controllers and the BRs. The controllers are of two types - AC and SC [2].

AC is the one which takes care of all the communication happening between the BS and the core network. The SC is the redundant controller and always in synchronous with the active status of AC connected with the help of an Ethernet link yet unaware of the resource allocation, maintenance and termination information carried out by the AC. In case AC goes out of service, SC takes over the responsibility of handling the communication but at the cost of a few call drops during the switch over process. AC distinguishes between the voice calls and the packet data and routes the traffic accordingly.

The BRs are transceiver modules that are controlled by the AC [3]. The two are connected through Ethernet links. These BRs actually perform communication with the MSs by providing them the operating frequency to make calls or send packet data. BRs send both the control information and the compressed speech over the radio channel. The antenna system is connected to multiple BRs and is responsible for transmitting and receiving signals. A BR can be removed and replaced with a new BR without taking the site off the air.

The OMC is a network element management subsystem that establishes a link, maintains it and collects information about the network and presents it to the system operator. The main functions of OMC are event/alarm management, configuration management, fault management, performance management, security management, collection of performance statistics etc.

II. Need of Remote Access to Base Station from OMC

Access to the BS requires a field technician to visit the EBTS site. BS issues can sometimes be hard to address because of the large number and remote locations of the sites. Data collection at the site can also be costly/time consuming, and in some cases may require several site visits in order to collect sufficient data. This current process limits the effectiveness and speed that issues can be addressed and resolved. It consumes a lot of time and increases the travel cost for BS troubleshooting. In turn the customers are affected when BS is affected because of malfunctioning of any component in it.

The BS has to undergo the health check procedure periodically so that the failures in BS can be avoided. It is difficult for a field technician to attend an issue in case of an immediate failure of any network element in the BS such as Active Controller or Standby Controller or any of the BRs. If the BS location is very far, then the field technician would take time to reach the site and also it would be time consuming to analyze the problem occurred and then fixes it. This will affect the users who are currently being served by the BS which is suffering from the failure which would make the service provider responsible for a huge loss of revenue.

A potential failure condition on the Standby Controller may go undetected and cause the BS site to lose its controller redundancy status. If the Standby Controller condition is not resolved, a necessary controller switchover may then fail due to the failure condition in the Standby Controller. There are some (but not all) alarms and state change traps currently being reported for Standby Controller fault conditions, and the Standby Controller may still be going out of service causing the BS site to operate without a redundant Controller.

There have to be a way wherein all the above issues can be addressed from one particular point without being physically present at the BS site immediately. The solution is to access the BS remotely.

III. Existing Methodology to Access Base Station

The alarms and events occurring at the BS can be noticed at the OMC. But when these alarms/events are obtained and there is a need to collect some data from any of the BS components i.e., AC, SC or BR, a technician has to be sent to the concerned site to collect the data.

At the base station site, the technician connects his system (service computer) to the RS-232 port of required component. He opens up the local console and queries appropriate commands to get the data regarding the component. The commands are processed by the corresponding BS component and the data file is generated at the local console itself as well as saved as a text file in a path provided by the technician. The data file is then opened by navigating through the path to analyze the issue. Once, the issue is understood, the technician shoots one or more command(s) to set right the component or configures the component according to the new requirement. Figure 1 shows how locally a system can be connected to the BS and the commands can be fired to the required BS network component to get the details out of it.

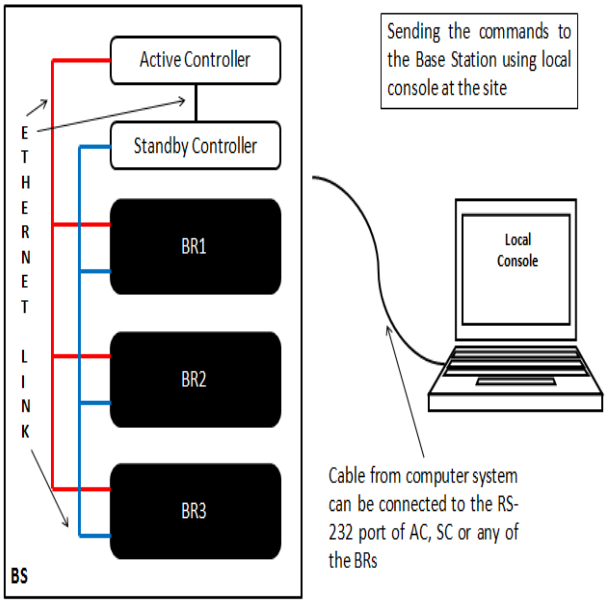

Fig. 1: Accessing Base Station using local console

In this method the data retrieval or any problem of the BS is resolved by attending it at the base station site which is time consuming and expensive too. It does not provide a quick procedure when it comes to data retrieval from the BS by going to the site.

IV. Proposed Methodology to Access BS Remotely

The consumption of extra time and loss of revenue mentioned in section 3 can be overcome by the implementation of Remote Access to BS from the OMC side which would help the authorized person to access and fetch BS data remotely from the OMC with the help of Simple Network Management Protocol (SNMP) and Trivial File Transfer Protocol (TFTP) as shown in Figure 1.

SNMP is used for communication between the network elements and here it is the OMC and the BS. The SNMP Set, Get and Response messages are exchanged between the OMC and BS to retrieve data from BS components i.e., AC, SC or BRs using the RAE tool at the OMC side [4]. TFTP is used to upload any data file to the OMC for the authorized user to view/access the BS data [5].

In this method, the OMC is considered to be located at the Network Operation Centre (NOC) where in the OMC operator can keep an eye on all the network elements through the OMC. BS is one among all the network elements.

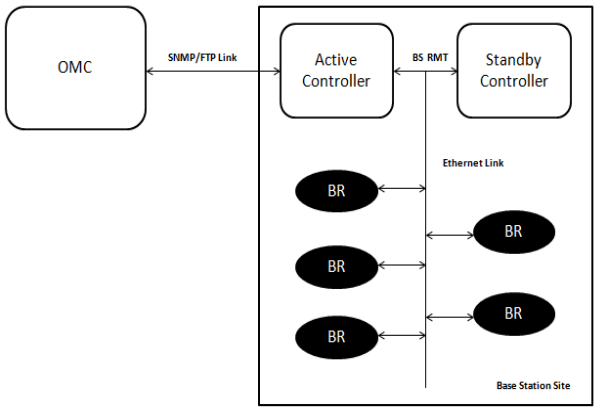

Fig.2: Architecture of Remote Access to EBTS from OMC-R

From Figure 2, we see that the communication between the OMC and BS happens over a link using SNMP/TFTP. The link is connected to AC/SC but not shown in the figure. Basically, the link between OMC and AC is functional since the resource allocation, management and termination is the responsibility of AC. In case, AC fails, controller switchover happens and SC becomes the AC and the now the link between OMC and SC (which switched over to AC) becomes functional. The AC is connected to SC via Ethernet link and both are in synchronous with each other at every point of time and SC knows only about the active status of AC and is unaware of the resource allocation, number of calls that are being handled by it etc. This interface is called BS RMT (Base Station Remote Interface) in this context because if there is a remote command for SC or any of the BRs, the interface is used to forward the same command from AC to corresponding BS component. Both AC and SC are connected to multiple BRs in the BS through Ethernet link.

Using the proposed methodology, the OMC operator can send command(s) to the BS from RABS tool implemented in the system connected to OMC, which is located in the NOC, to get any data file by using SNMP and TFTP. The SNMP messages carry one or more commands to the BS from the OMC which are executed at BS as well as they are used for sending back the response from BS to OMC. The TFTP is used to upload the data files which are generated after the processing the remote BS command(s) only and not any other data file which were generated due to commands sent from local console before. The complete path involved in remote access to BS is shown in Figure 3. The command(s) is/are given as the input to the RABS tool which is/are carried in the SNMP message in the network. OMC, being situated on the IP cloud, connects to other network elements in the system through routers. The remote command(s) fired from the OMC, passes through the router, DACS (Direct Access Cross connect System) and finally reaches the BS. The remote command(s) are processed at the Base Station and the output file generated is sent back through the same network elements using TFTP as shown. Hence, the link between BS to OMC or vice- versa is termed as SNMP/TFTP link.

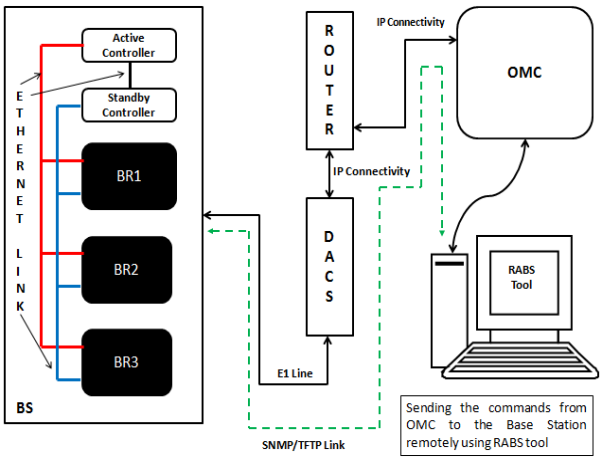

Fig. 3: Accessing Base Station using Remote Access to BS tool

V. PROCEDURE OF IMPLEMENTATION

The implementation of the proposed method includes three major sub parts in it. First, is to identify the requirements that would fulfil the need of Remote Access to Base Station from OMC. Second, is to develop a tool i.e. RABS tool at the OMC side to accept the commands from the OMC operator and send them to the BS side. The changes introduced for remote access should be supported by both OMC as well as the BS when incorporated in both the network elements. Thirdly, identification of various scenarios and create and execute the test cases to validate the remote access to Base Station from OMC.

The requirement for the project is shown in the form of flowchart in Figure 4.

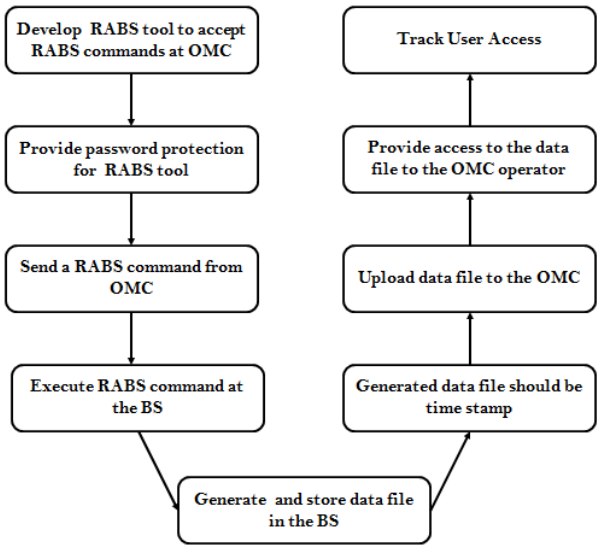

Fig. 4: Flowchart for identifying the requirements of the project

The requirements shown in Figure 4 are implemented in UNIX environment using C++. The RABS tool is designed, developed and installed on the system connected to the OMC as Figure 3 shows. The RABS tool is developed in such a way that only one instance of it can be opened at any point of time as it is used to send commands to the BS which is used for the retrieval of any important data remotely. It is used to avoid multiple users sending request for data files and overloading the BS at the same time. Hence, the RABS tool is password protected and is accessible to the authorized user/ OMC operator only (one user at a time). After the OMC operator logs into the RABS tool, he types in the command meant for AC, SC or any BR. The command(s) is/are sent using SNMP Set (request parameter) messages. Upon receiving the SNMP message(s), the BS sends SNMP response to OMC indicating successful reception of the request message. The AC identifies the BS component for which the command is meant for. If it is for AC itself, it processes the command and generates a data file which has a time stamp. If the command is meant for SC or BR, the AC forwards the corresponding command to the concerned BS component using the Ethernet link. The SC or BR process the command and send the output to the AC which consolidates the result and forms the data file. After certain time, the OMC sends a signal/message to BS (AC) indicating to stop any more data collection, if any and keep the data file ready for upload. Followed by this indication, OMC sends another signal/message to upload the file for which the BS sends a response. The response means that the data file is ready to be uploaded. In case, there are no data files for upload, no response is sent for the upload message from OMC. The data file generated is then sent back to the OMC, in turn to the system connected to it using TFTP. The data file is a text file which has the output of the command request sent to the BS in the start with the date and time mentioned. It can be viewed by the OMC operator. The proposed method also has an option to track the user access using the tool i.e. the user ID and time of access to BS can be viewed.

The fundamental goal of any research is to improve system quality and reduce maintenance costs through systematic regression testing. Successful regression testing depends on the ability to economically maintain and execute a large set of test cases throughout the life span of a software system. After the code is written and incorporated into the network system, OMC in this case, all possible positive and negative scenarios are identified to validate the working of the feature “Remote Access to BS” and is called System Integration testing. Test cases are developed for the scenarios identified and for each case the tool and its working is tested. If any case fails, defect is raised and assigned to the developer. The development team fixes the defects and the failed cases are re-run to check the functionality. The procedure is followed until every possible check is done on the working of RABS tool. When all the test cases are passed, proper functioning of the remote access to BS using RABS tool is confirmed.

VI. RESULTS

The RABS (Remote Access to Base Station) tool was developed successfully on UNIX platform (on which OMC runs). All the commands that were used at the local console are also supported by the RAE tool. The commands are quickly processed by the concerned BS components and the results are sent back to the OMC in the form of time stamped data files which are viewed and analyzed by the OMC operator. The tool

also helps to track the number of users who have accessed the Base Station remotely and the time too.

VII. CONCLUSION

The remote access mechanism avoids the need of a technician to go to the BS installed at the site and take the required data with the help of local console. The data can be retrieved remotely in a few minutes. Since, OMC connects to a number of base stations in a given geographical area, all the BS can be kept under check remotely. It minimizes several site visits in order to collect sufficient data making it more effective and providing speedy resolution of issues. Time consumption due to travel and cost is reduced to a greater extent for BS troubleshooting. In turn, the end users stay almost unaffected thereby reducing the revenue loss incurred by the service providers. Thus, the customers are much less affected when BS is affected because of malfunctioning of any component in it which actually reduces the revenue loss seen by the service providers.

VIII. REFERENCES

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