

WEB BASED MOBILE NETWORK PERFORMANCE MONITORING

Poorvika R¹, Mahalakshmi M. N.²

¹ Student, Dept. of Telecommunication Engineering, Karnataka, India

² Professor, Dept. of Telecommunication Engineering, Karnataka, India

Abstract - Network monitoring is necessary for business. The whole purpose of it is to monitor the network's usage and performance and check for slow or failing systems. Web based viewer for mobile network performance monitoring has the capability to provide near real time reporting about the network events like Sleepy cells, Auto, Manual Downtime, in cell level, RNC outages, etc. based on the criticality. This paper reports the events which represents the network elements that match the predefined performance signatures by alerting the system administrator with an alarm or an email.

Key Words: BSC, BTS, RNC, MCD, GNO, KPI, LTE, GSM

1. INTRODUCTION

A reporting tool is the one that reports certain network events to users. The Network events represent the network elements that match the predefined performance signatures. These performance signatures are defined in XML files as test sets. Each network event represents one network element that matches the performance signature. The application reports customer-impacting events as soft alarms. The reporting application modules are scalable and distributed services which can be easily upgraded and can serve the requirements of 3G/4G/5G technologies.

2. REPORTING APPLICATION

2.1 Business functionalities of the application

Reports near real time network events to the users. Displays soft alarms to users so that they can know about events that may impact customer service. Displays the events on the web interface, which makes it easier for the users to manage.

2.2 User Groups of the application

1. Mobile Coverage Delivery (MCD): This group is responsible for Network Optimization. This group forms 60-70% of the total application user community.

2. Global Network Operations (GNO): This group does the management of customer impacting events. This forms 10% of the total application user community.

3. End to End Analysis Groups: As the name suggests, this group does the End-to-End Analysis of Network. This forms around 10-15% of the total application user community.

4. Other Groups: The remaining set of users is the different groups engaged in maintenance and enhancement of network performance.

3. METHODOLOGY

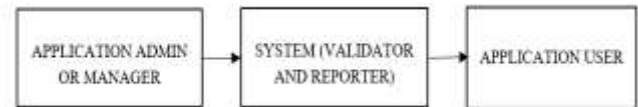


Fig -1: Block Diagram of the application

The block diagram of reporting application is as shown above in Fig. 1, it is made up of three blocks manager, validator and reporter and the application user, the responsibilities of each block is explained below:

3.1 Application admin or Manager

Responsible to manage the Network Events that needs to be carried out against the Network Key Performance Indicators (KPI) data. Main operations of MobiWatch Admin are:

- Create a Network Tests for 3G/4G/5G elements. Update a Network Tests at real time.
- Schedule the tests for quarterly, hourly and daily Frequency. Update KPI Queries and Update Severity. Pause Tests whenever required.
- Delete a Network Tests. List Network tests by Technology, By Frequency, and By Severity.

3.2 System: System is made up of two blocks:

Application Validator: Responsible to validate the Network Events at specific frequency intervals or ad-hoc as per user request against the relevant data source and as per the Event queries and additional business logic, generate the Application events that needs to be captured and forward the same for storage and alarms. Major operations of Validator are:

- Validate the Network tests at Regular Frequency - Quarterly, Hourly, Daily. Validate Network tests on user request.
- Perform any business requirements on the tests.
- Capture the Network tests and forward the same to reporter for storing and alarming.

Application Reporter: Responsible to capture the events from admin and store them against the application events database. Also, responsible to raise alarms for events that are marked as ALARMS. Responsible to serve the UI with the list of events based on various filters. Send emails/alerts to users who have subscribed to specific events based on Event Type, Technology and Node. Major operations of Reporter are:

- Capture the tests generated by validator and store them against the tests database. Collect and store statistics related to Tests Execution time.
- Send emails/alerts to users who have subscribed to specific tests based on Tests Type, Technology and Node.
- Capability to list tests by Technology, Severity, Frequency, Node and combination of all.

3.3 Application User

The user logs in to the application dashboard, views the report of 3G/4G/5G nodes, search and filter by specific requirement, once the user finds the report downloads it to the machine.

4. IMPLEMENTATION AND RESULTS

4.1 Create Network Tests

The codes are developed in such a way that the system is able to create Network tests based on the user inputs available so that when the tests are scheduled then system is able to Create a new Network Tests by providing the event details. User inputs are available from User Interface and user has triggered Create Tests flow and then system should be able to read all the user inputs, process & store them in Data Base. Tests Name, Tests Frequency, Tests Region, Tests Status, Tests type, Tests Description, Tests Start date, Tests End date, Tests query, Tests Technology, Created By, Created on, AutoClear, AutoClearTime, isAlarm are the mandatory fields. The fields marked with * are mandatory inputs.

- Tests Name * – Unique Name provided by the user.
- Tests Frequency * – Preferably user input. Add extra validations.
- Tests Region – Possible Values ACT, NSW, NT, QLD, SA, TAS, VIC, WA.
- Tests Status – Auto populated when created and not a user input.
- Possible Values “SCHEDULED” – For anything which is in running state and “SUSPENDED” – Tests which are paused.
- Tests type * – User Input Value.
- Tests Description * – User Input Value.
- Tests Start date * – Auto populated to current date. The date from when the system should consider the tests to be run.

- Tests End date – The date till when the system considers the tests to be run.
- Tests query * – User Input.
- Tests Technology * – Possible Values. 3G (WCDMA), 4G(LTE), SMS, Volte, 5G(NR), Core Network, NBIOT, CAT,2G(GSM).
- AutoClear * – Yes/No:
- AutoClearTime – If AutoClear is Yes – Then AutoClearTime is mandatory & will be user input which is more like Frequency, IF no then it is null.
- isAlarm * – Yes/No
- ExcludeHolidayRun * – Yes/No, Day of the week Sunday to Saturday to make the tests run for configured days of the week only.

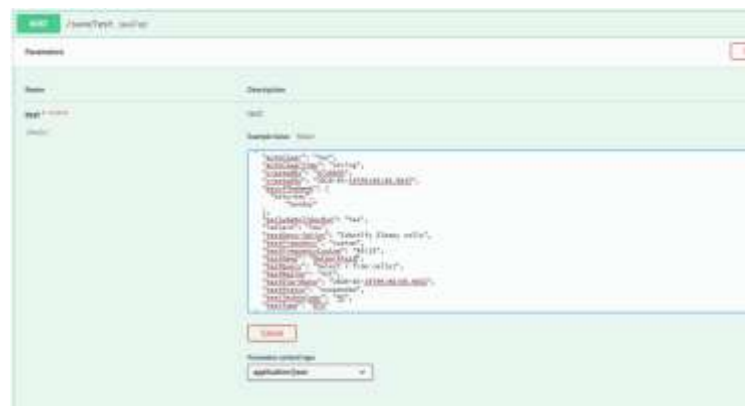


Fig -2: Screenshot of the code tested for save tests



Fig -3: Code tested for correct user inputs

The above images demonstrate the code tested and we can observe in Fig. 2 that user has entered correct values to all the fields and the in Fig. 3, system stores the Network tests details in database and displays a success message. In Fig. 4 the user has entered wrong entries which is reflected by the code in Fig. 5 and Fig. 6 as bad response along with error messages stating the wrong entry made by the user and specifies what needs to be entered for the region, so that it provides a high functional user interface.

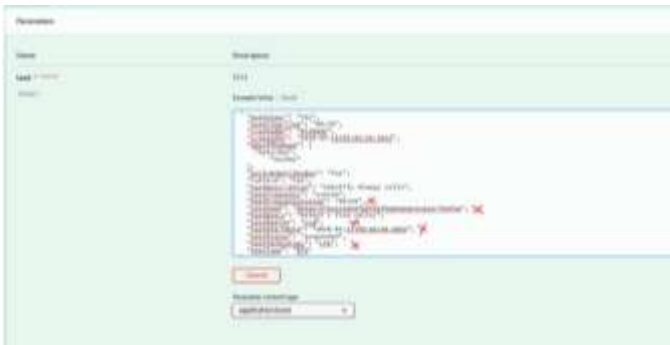


Fig -4: Code tested with incorrect user inputs



Fig -5: Bad Responses displayed

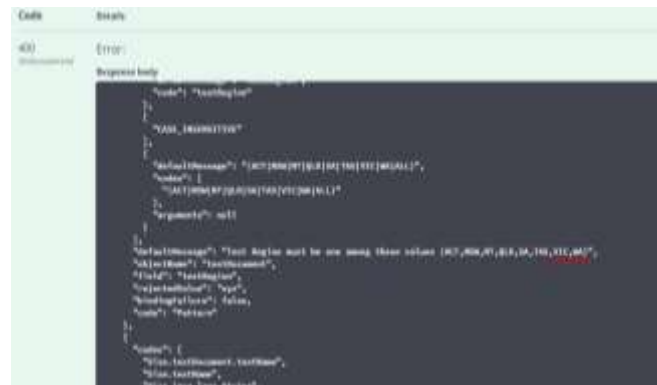


Fig -6: Bad Responses displayed with correct possible values

4.2 Delete Network Tests

The codes are developed in such a way that system is be able to delete any selected scheduled network event so that no tests or alarms are triggered for the same in the next run. Delete any selected Scheduled or Paused Network tests, given user has the list of all the scheduled or Paused tests. When user selects any particular event and triggers delete

Event flow, then system should be updating the Event Status of the selected event as “DISABLED”.

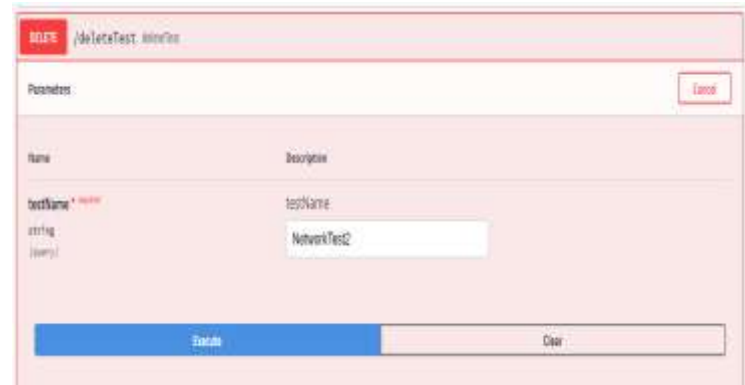


Fig -7: Screenshot of the code tested for delete tests



Fig -8: The entered test is deleted with success message



Fig -9: Screenshot of the code tested for network tests which is not present in the database



Fig -10: Bad Responses displayed

Delete network tests is a feature which is used to delete the network tests that are saved and stored in the database. Tests that are saved can be deleted using this feature, in case if an unsaved network test is tried to delete, the code responds with an error message, stating that the specified network test does not exist. We can observe in Fig. 7 the user enters the values for the field to delete NetworkTest2 which is stored in database, hence the code is succeeds and deletes the specific network test as seen in Fig. 8 when the user enters a test name which is not present in the database as seen in Fig. 9, user gives a test name which is not stored, hence the system is unable to find specified test in the database therefore the code responds with an error message guiding the user to enter a valid input as in Fig. 10.

4.3 View Network Tests

The codes are developed in such a way that the system should be able to list/view all the Network tests so that user is able to view and understand all the existing Network tests along with the details if it is scheduled or paused. Network tests are available in the system when user wants to view the tests, then system should fetch all the scheduled and paused tests available in the system and display the same to the user. Search options to view the tests should be on any of the below options:

- Event Name, Event Frequency, Event Region, Event type.
- Event Status – Possible Values “SCHEDULED”, “SUSPENDED”.
- Event Technology – Possible Values. 3G (WCDMA), 4G(LTE), SMS, Volte, 5G(NR), Core Network, NBIOT, CAT,2G(GSM).
- Created By and isAlarm – Yes/No.

User intends to view the stored tests hence enters the testName as networkTest2 as seen in Fig. 11, which is taken as input and the code finds the specified test in database and displays the details of that test as we can observe in Fig. 12.

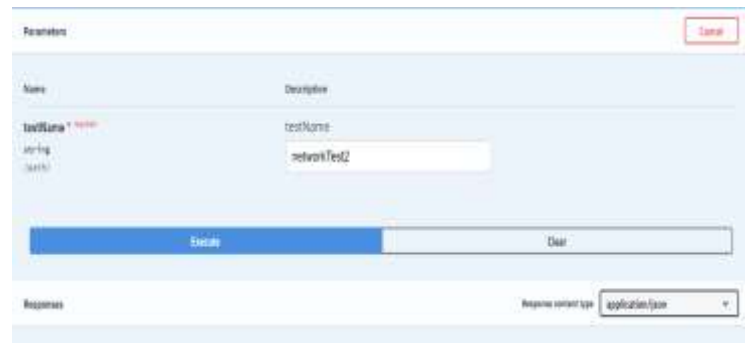


Fig -11: Screenshot of the code tested for view tests



Fig -12: Application displaying the network test

5. CONCLUSION

In this paper an application which reports a real time network event is developed, which is associated with creation of network tests, updating of network tests and other related activities. This application can fetch real time network events once it is implemented in any server which collects and stores network related data. Incorporating this application into the system achieves the reporting operations and helps us to analysis the performance of the network in a very efficient manner. Therefore, the main application of this reporting tool is to analyze the network performance and to correct the issues at the earliest without causing any issues to the customers of the network.

REFERENCES

- [1] M. Bertocco, R. Tittoto, E. Rizzi, and L. Benetazzo, "Statistical analysis of measurements for telecommunication-network troubleshooting," *IEEE Trans. Instrumentation and Measurement*, vol. 52, no. 4, Aug 2003.
- [2] Jussi Turkka, Fedor Chernogorov, Tapani Ristaniemi and Amir. Averbuch, "Detection of Sleeping Cells in LTE Networks Using Diffusion Maps," in Proc. 73rd Annual IEEE Conference on Vehicular Technology (VTC Spring), Yokohama, Japan, May 2011.
- [3] Oliver Jukic and Marijan Kunstic, "Integrated view on telecommunication network status," in Proc. 34th International Convention MIPRO, Opatija, Croatia, May 2011.
- [4] Jean-Pierre, Giovanni Pacifici and Asser N. Tantawi, "Integration of Internet and Telecommunications: An Architecture for Hybrid Services," *IEEE Trans. Selected Area in Communications*, vol. 19, no. 9, June 1999.
- [5] Anand Balachandran, Geoffrey M. Voelker, Paramvir. Bahl and P. Venkat. Rangan, "Characterizing user behavior and network performance in a public wireless LAN," in Proc. 31st Sigmetrics Proceedings of the ACM Sigmetrics international conference, San Diego, La Jolla, CA, June 2002.
- [6] R. Ramjee, T. La Porta, K. Varadhan, S.Y. Wang and L. Salgarelli, "HAWAII: a domain-based approach for supporting mobility in wide-area wireless networks," in Proc. 7th International Conference on Network Protocols, Toronto, Ontario, Canada, Canada, Aug 2002.
- [7] E. Ezhilarasan and M. Dinakaran, "A Review on mobile technologies: 3G, 4G and 5G," in Proc. 2nd International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM), Tindivanam, India, Oct 2017.
- [8] Patrick Kwadwo Agyapong, Mikio Iwamura, Dirk Staehle, Wolfgang Kiess, Anass Benjebbour and Steven Bergren, "Design Considerations for a 5G Network Architecture," *IEEE Communication. Mag.*, vol. 52, no. 11, Nov 2014.