DEVELOPMENT AND SIMULATION OF NEXT GENERATION SDH NETWORK MANAGEMENT SYSTEM

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ABSTRACT

In present scenario Network Management System of Next Generation SDH is not performing Offline reporting, offline analysis of alarms, offline performance management and Configurations of network like real time. Any offline configuration of a network when implemented on a real time environment leaves some shortcomings and wrong configuration attributes due to non-availability of Alarms and Performance Management in the presently available offline utility. A simulated platform is developed for implementation of a traffic matrix in an offline environment before implementing over a real time NG SDH Transmission network to reduce the chance of faults or any network disaster.

INTRODUCTION

The last two decades have seen so many evolutions in optical fiber transport technologies from PCM, PDH, SDH (ITU-T G.707 and its extension G.708), NG SDH/Ethernet/RPR, DWDM/ROADOM/ASON/OTN and now IP over WDM. Currently NGSDH is deployed in Backbone, Metro transmission, OFAN, MSAN, and Cellular BTS hub sites. The NGSDH introduces new standards GFP (Generic Framing Protocol ITU-T G.7041), VCAT (Virtual Concatenation ITU-T G.707) and LCAS (Link Capacity Adjustment scheme ITU-T G.7042) to improve network efficiency and broadband service potential. NGSDH was introduced to provide strong network management by sacrificing the bandwidth in SDH frame. Due to its improved management capabilities, complex multiplexing structure and difficult service configurations there are few chances of wrong configurations in NGSDH transmission network. None of the telecommunication operator could bear a loss of single frame. A loss of one frame can trigger the outage of few seconds that could get extended up to few minutes and this outage may cause the revenue loss of million dollars in case of site outages and services disconnections.

In order to overcome these disasters there should be a platform for implementation of complex traffic matrixes before implementing over a real time network. This paper focuses on the simulation and analysis of NGSDH service configurations so that all the services configuration alarms could be monitor on this platform. A powerful Graphical programming tool Visual Basic.Net is used for implementation of all the traditional SDH and Next Generation services in this simulation to provide the analysis of alarms and monitoring of all the configuration steps for implementation of a traffic Matrix. This simulation offers the configuration of E1, E3, FE (Fast Ethernet IEEE 802.3) and GE (Gigabit Ethernet) with advanced EOS (Ethernet over SDH) and RPR (Resilient Packet Ring) services features (Level-A, Level-B and Level-C) with physical and logical ports status on Point to Point, Point to Multipoint, Ring and Mesh Networks are shown in Fig: 1. In addition to the configuration of transmission services on this platform, all the services alarms are appearing in this simulation that will be more helpful to monitor each and every step of complex NG SDH service configurations structure.

NGSDH NMS Simulation Features

The results of this simulation includes all the existing offline NMS features like Login Management, NE Creations, Link Management, Cross-connections, MS protection, Trunk configuration, Clock source configuration, Ethernet Management (VLAN configurations, EPS Protection Setting, Configuring RPR VLAN domain, VCG Port Capacity configuration, LSP Configuration, EPL

Configuration, UNI/NNI Port Link Profile, and MFDR configurations) etc.

In addition this simulation introduces some extra features that are only found in online real time Network environment, like Current performance Management, performance statistics, VCG Performance Management and Alarms Management of physical and logical ports. All types of alarms for optical links debugging on physical ports of SDH line boards like LOS (Loss of Signal) due to fiber cut or AIS (Alarm Indication Signal) due to no optical power received at remote end can be seen in this simulation as shown in Fig: 2. Alarms on Ethernet boards like "Ethernet Port Link Down" on physical ports and on logical ports like "VCG Port link down" can easily be monitored in this simulation as shown in Fig: 3. Status of SDH protection schemes like Linear Protection on point to point dual fiber Networks, Multiplex section Protection scheme on SDHRing Networks and Sub Network Connection Protection on SDH nodes can easily be monitored.
The purpose for implementation of all protection schemes on SDH networks is for automatic switching of services on alternate routes as in case of hardware failure and fiber cuts, APS protocol is used. With the help of these alarms management, protection and performance statistics all the service alarms of each line and service board can easily be monitor on each and every step either both service configurations and its parameters are defined in right directions or not. If any mistake will be done by a network manager while performing services configuration activities, this simulation will indicate the status of services either these are configured properly or not.

Problems during new services configurations

According to a network survey most of the time telecommunication services outages are observed due to fiber cuts during construction activities, pressure points on optical fiber, malicious fiber cuts, planned maintenance activities and wrong service configurations during the implementation of new traffic matrix on a real time running network. To perform such type of critical network shifting up-gradation or maintenance activities on any metro or Long haul transmission network a Network Manager always request for downtime approvals and most of the time service outages are observed due to wrong service configuration settings that are unexpectedly configured by Network Manager. Fig: 4 shows the graphical representation of faults observed due to fiber cuts, pressure points, planned maintenance activities and wrong configurations performed in the approved Maintenance windows. This simulation tool will provide 99% security level against the implementation of wrong transmission services configurations.

Solution to overcome Network outages

During the configuration of new bandwidth all the services alarms could be monitor on each and every step. If a network manager will unexpectedly perform any wrong configuration activity, this tool will inform network manager by indicating the alarms of wrong services configurations, rather it is on physical port level (Los of Signal on P_n where n=1, 2, 3, 4 etc.) or logical port level (VCG Port Down). Preventive maintenance can be done on NMS to reduce the redundancy loss in case of dual and triple fiber cuts. Pre implementation of planned activities on this simulation for network resource optimization and efficiently utilization of bandwidth can be done. Pre Implementation of unplanned activities to switch over the effected wavelengths on redundant paths to reduce the restoration time in case of fiber cuts. Fig: 5 show the graphical representation of Fiber cuts and average restoration time of six months of an optical fiber transmission network. Number or fiber cut occurs in a transmission network and average restoration time of these cuts is about five to six hours and service shifting on the redundant links also takes about an hour. To reduce the restoration time up to 15 minutes these scenarios can easily be implemented on this simulation.

Advantages of NG SDH simulation

This simulation has provided a platform for implementation of all NG SDH services with alarms indication and insertion on every step of service configurations. 20% of network outages that were observed due to wrong configuration settings and delay in new services implementation could be overcome. It is more helpful for dramatically time reduction of configurations during downtime activities to mitigate the risk factors. Contingency plans could be prepared and implemented on this simulation if its utilization is required in case of any emergency. Moreover efficient utilization of

bandwidth resources can be done by reducing the configuration complexity and selection of shortest possible and protected routes. Physical and logical port status could be monitored before implementation of a traffic matrix on real time network. This simulation is also useful for training of new network managers with improved configurations statistics. None of the operator could take a risk for fresh network manages to perform training activities on real time Network Management System. Transportation cost can also be saved by reducing the Network Operation Center visits (NOC).

Conclusion

Implementation of a strong NGSDH Network Management System on a specially designed simulation tool is useful for configuration of a traffic matrix before its implementation on a real time network by alarms visualization to reduce the
chance of fault and wrong configuration settings. Pre Implementation of services on this simulation to reduce the restoration time for both planned and unplanned activities. Pre implementation and verification of services before its switching on alternate routes in case of any network disaster.

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