CAREER EPISODE 1

BTS Swap from Alcatel Base Transmitter Station (BTS) to NOKIA Multi-Radio BTS

A) Introduction

[CE 1.1]

Title: BTS Swap from Alcatel Base Transmitter Station (BTS) to NOKIA Multi-Radio BTS

Duration: [Date] – [Date]

Location: Nairobi, Kenya

Organization: Nokia Solutions and Networks

Position: Field Engineer

B) Background

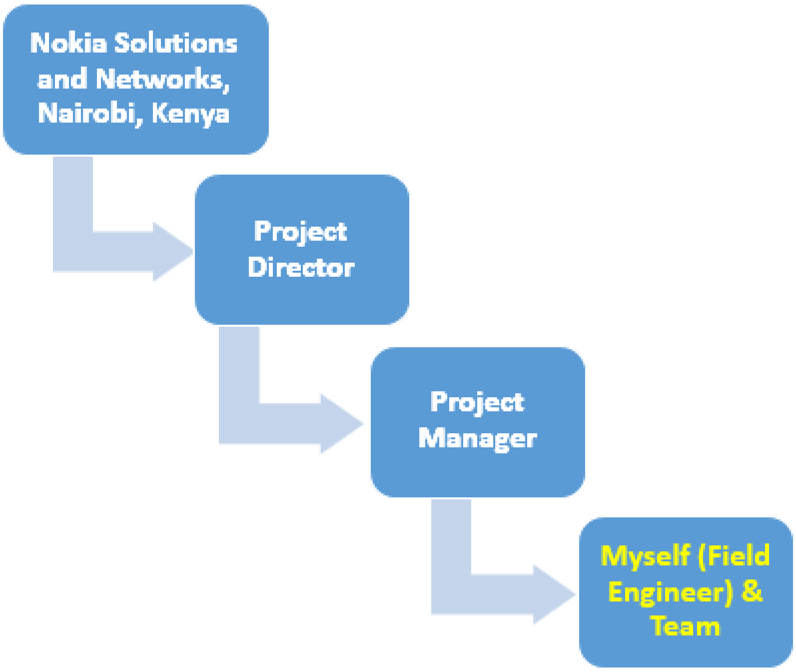
[CE 1.2] Kenya experienced a rapid growth in demand for data services that was fuelled by increased proliferation of smartphones; this triggered the UMTS 900 MHz spectrum upgrade which aimed at enhancing indoor coverage penetration and improved quality of data services for customers across the available networks. This prompted the upgrade by Airtel Kenya, of its network sites in major towns within the country, in partnership with the Nokia Networks.

[CE 1.3]The work was done for BTS swapping from Alcatel Base Transmitter Station (NS) to Nokia Multi-Radio BTS. I was the part of the project as the Company's Field Technician in the South Rift, North Rift and Central regions of Kenya. My overall responsibility was to check installation quality and to ensure end to end transmission routing. I was also tasked with commissioning and integrating Nokia Multi Radio BTS after ensuring quality of service, and the decommissioning Alcatel BTS. The installation of Multi Radio System Modules (ESMB/C) and RF Modules. This included assembling the right tools e.g. 25 nanometer torque screw drivers, multi meters and properly mounting and grounding the modules

[CE 1.4]The work nature was carrying out the expansion of GSM carriers 900 MHz and 1800

MHz Frequency Bands: In this assignment I deployed different RF modules for each frequency i.e., FXDA for 900 MHz and FXEA for 1800 MHz and also different fiber optic cables and SFPS. GSM Antenna swap from mono port to duo and Tri Band Antennas. I mounted the GSM antennas' properly while ensuring conformity to final site configuration in terms of mounting, height, lobe direction, mechanical tilt angle, electrical tilt angle and that all feeder cables, connectors were well done.

[CE 1.5]



[CE 1.6] Responsibilities:

- I worked on transmitter checking availability with the time slot allocation plans which confirmed the status of the process.
- I did transmitter availability checking along with allocation of time slots which was followed with confirming the jumper connections, commissioning, connections and transmission settings.
- I made SUMA utilization which provided BTS controlling and central management was done accordingly for carrying out digital transmission.
- I conducted an analysis on the clock and timing generation which resulted in BTS internal digital interfacing.

C) Personal Engineering Activity

[CE 1.7] I did BTS commissioning and I carried out the deployment of the BTSs to be on service after ensuring all the laid down specifications had been met as per the checklists. The commissioning process included checking availability of necessary documents and test equipment needed, checking installation of plug-in units and interconnection cables for modules as well as checking polarity of power cables before powering of the BTS and recoding of DC voltage at ESMA. After this, I connected the RJ45/LAN Cable to ESMA card and start the BTS Manager then initialize the equipment by Creating HW configuration, checking the BTS SW and Manager SW Versions. Finally, I measured the power levels of each TRX (Watts/dBm).

[CE 1.8] I executed the external alarm termination and testing. In this case, I ensured that all external alarms were well terminated on both the load STE and integrated on the BTS with correct polarity. These alarms included, but were not limited to Mains Failure Alarm, Rectifier Failure, Battery Discharge, Generator running, and Defect on generator, Low level fuel tank and Intrusion. I executed the FLEXI MR BTS Integration and this was the process that connected the newly installed NOKIA Multi Radio BTS to active network service. At this stage, I checked the availability of TX and time slot allocation plans and confirmed status of the commissioning, jumper connections, transmission settings and connections settings. I then filled the integration report. NODE acceptance. I prepared the site for acceptance by ensuring that; Installation was of the required standard.

[CE 1.9]I mounted the modules and I corrected the module earthing and jumpers water proofing was satisfactory. All cables were well fixed and tight. I set the site parameters which were all correct along with VSWR values. These were within the defined threshold of 1.1 and I made the site clean by removing all packaging and un-sued materials. I delivered the BTS with mounting the associated parameters. I did earthing and power connection of BTS of identified jumpers for BTS commissioning as requested. I executed the BTS commissioning into live networks which were for integration. I completed the BTS installation activities along with test result availability analysis. I analyzed the obtained RF testing and accomplished the programming activities. Furthermore, I did transmission links testing for test result and connectivity availability. I did fault clearance intervention with non-environmental and BTS integration testing. I implemented testing rive with performing BTS reconfiguration. I performed Standard Operation and Maintenance Procedures. I loaded BTS software new version along with integration on-site BTS commissioning and networking. I implemented configuration and transmission plan. I checked the alarms and fault clearance, or fault notification. I made drop call-in investigation with solving and optimization. I investigated on problem identification along with customer complaints. I investigated the site issues and identified the problem identification.

[CE 1.10] I did ABIS interfacing which connected the BTS to the BSC and there were four connectors. I utilized four relays and mainly controlled with LOCK fastener, ANC module, module, extractor, antenna network combiner, and transmitter connector. There were three levels which provided intermediate RF stage among the antenna and TREs. I combined the output signals which were up to four transmitters and connected up to two antennas. I fed the received signals from the antenna to the front end of the radio and the signals assisted in amplifying and distributed to eight receivers. It allowed simultaneous transmission and antennas receiving. I provided filtering to the transmitter and receiver. I provided lock fastener, transmitter connector, module extractor, and equipment labeling and antenna connector. I executed the passive RF module which provided with power supply. It worked as optional RF distribution device which was utilized for expanding the ANC capacity. Thus, it worked as an extension unit to the module.

[CE 1.11] I executed the TRE which performed the functioning of SUM interfacing along with analog functions interfacing to the 'AN' module interface. It provided TRE interfacing for factory test purposes. The transmission provided RF interfacing to an 'AN' module. Both the receivers assisted in providing two RF interfaces from an 'AN' module. I utilized the SUMA which provided BTS control and central management and was specifically responsible for digital transmission. I analyzed the timing and clock generation which was followed with BTS internal digital interfacing with O and M functions. I utilized a switchable 2 Mbits/s duplex connection among the BSII and the Abis interface. I utilized it specifically for transferring the TCH information to the TRE module. The Q1 linking was done in a logical manner and performed remotely from the BSC.

D) Summary

[CE 1.12] The work specific targets were accomplished with the technical telecommunication engineering expertise applied in an adequate manner. There were scenarios in which I split the technical activities and achieved the project goals within the defined work timeline. The technical skills in the telecommunication engineering domain boosted significantly with the work activities accomplishment in the project.

CAREER EPISODE *2*

Microwave Link Installation and Commissioning

A) Introduction

[CE 2.1]

Project: Microwave Link Installation and Commissioning

Duration: [Date] – [Date]

Location: Nairobi, Kenya

Organization: Nokia Solutions and Networks

Position: Field Engineer

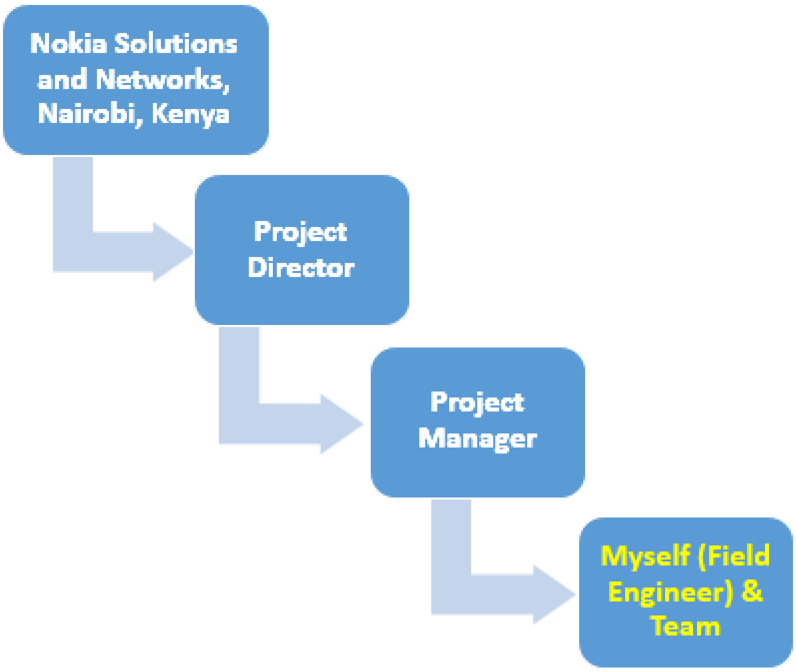
B) Background

[CE 2.2] Microwave links are line-of-sight wireless communication technology equipment that makes use of high-frequency radio beam waves. This technology provides high-speed wireless connections for sending and receiving video, voice, and data information. Microwave links are popular for point-to-point communications as their small wavelength allows conveniently-sized antennas to direct them in narrow beams, which can be directed at the receiving antenna in a direct line of sight, therefore, allowing nearby microwave equipment to use the similar frequencies without interfering with each other. Lower frequency radio waves are very prone to such interference. Additionally, the high frequency of this technology allows the microwave band a comparatively large information-carrying capacity; it has a bandwidth 30 times that of other radio spectrums below it.

[CE 2.3]The work aim was specifically based on carrying out the installation and commissioning of microwave links which was done with the constant expertise applied in the telecommunication engineering domain. All the related work objectives were accomplished using the telecommunication engineering expertise with a thorough discussion made with the project manager.

[CE 2.4] Throughout my career, I have been involved in projects to install and commission the important telecommunications equipment. My career episode in this regard was a major microwave link upgrade during the introduction of the 3G network in the Kenyan market. As the Field Engineer in Kenya's North Rift region, I was tasked with the hands-on installation and commissioning of the MicroWave links during this time.

[CE 2.5]



[CE 2.6] Work responsibilities:

- I worked on checking the lightning protection for the antenna system.
- I applied the appropriate positioning of the cable ladder and it accessed to cabinets proper side for the co-axial feeder.
- I made sure to ensure the antenna sealing which

was fitted properly and polarization was executed accordingly using the telecommunication engineering skills.

- I made partial and full site decommissioning services which worked with proactive maintenance activities.

C) Personal Engineering Activity

[CE 2.7]With the advancement of Telecommunications technologies, Microwave radio transmission is now commonly used in point-to-point communication systems on the surface of the Earth. It is also used in deep space radio communications and satellite communications. Some of its bandwidth resources are useful in radars communication among others. In this project, I performed the preliminary checks in which I accessed/utilized permission to building or area was arranged (e.g. site keys, securityclearance). I worked on ascertaining the site of workplace safety. I did checking lightning protection for the antenna system. I checked the cable ladder/support structure from the antenna to the entry point to the cabinets. TX cabinet position and layout in accordance with Nokia Siemens site-specificdocuments. I did cable ladder positioning and cable access to the top proper side of cabinets for coaxialfeeder cables checked. Microwave Link equipment grounding busbar or ground cables installed andconnected to the main site grounding system.DC power distribution board with clearly labeled fuses/circuit breakers for eachcabinet checked. I checked the availability of the DC Power system.

[CE 2.8]I executed the installation phase and related documents checks in which deliveries were completed and checked, shortcomings recorded. I noted that the equipment was not damaged and the antenna layout checked for differences to the drawings and recorded. I checked antenna steelworks grounding along with coaxial cable routes checking. Moreover, I did coaxial cable trays checking and antenna mounting height checked according to the final site configuration. I did antennas mounting according to site-specific documents. In the next stage, I did a microwave antenna outdoor and indoor system installation. After completing the preliminary site and deliveries checks including if the supplied antenna was the correct model and size, installation works begin. With the help of riggers, I did the complete link installation on both ends as per the link budget i.e.,ensuring the 1.2-meter antenna was securely fixed to mount, observing the high low violation and getting the correct antenna height and azimuth on both ends. This process also involved ensuring mount was secure, perpendicular, was of sufficient height to clear local obstructions, was safely positioned not to cause a safety hazard, and was grounded as per site specifications. I also ensured antenna sealing O-Ring is properly fitted and its polarization was as per link requirements. Additionally, I made sure both ODUs and IDUs were properly grounded and both the ODU and the cables were properly waterproofed.

[CE 2.9]I did link commissioning in which the IDUs powered up after ensuring correct power polarity with my laptop logged in with default configuration in order to be able to upgrade the software of both IDUs and ODUs. Using provided frequencies, I thereafter configured the parameters of one end of the link i.e., link frequency and power levels, and did frequency interference test while the other side of the link was switched off. I then proceeded to site B of the link and repeated the same procedure. After confirming the absence ofany interference, I started the link panning to get the desired link power levels.I executed the link panning and fine-tuning to the desired levels followed and I did final configurations i.e., capacity, correct modulation as per planning, and configuring the link IPs as provided, for link visibility.

[CE 2.10] I did fine alignment of the ODUs which were connected at both ends and these were properly attached to the antenna via direct mounting. I powered the ODU far end and conducted the transmission. I ensured that the far end transmitter frequency matched the local receiver frequency. I did not set the transmitter output power and the antenna was turned off. During the installation process, I kept the alignment mode 'ON'. I executed the fine alignment process in which azimuth angle was set over 30 degrees and it turned to adjust bolt in $1/10^{th}$ turn increments for avoiding the main lobe. I turned the local transmitter 'ON' and it was aligned at the far end. I worked on moving to the link far end and locked down the antenna with the installation which was conducted at the antenna side. I checked the connector seals and turned the alignment mode 'OFF'.

[CE 2.11] I executed the microwave link installation and performed the link alignment and testing. I worked on précising the antenna alignment at both links ends and final radio configurations were done as needed. I obtained the traffic continuity validity at the designed link throughput speeds. I measured the latency along with throughput values utilizing standard RFC testing. I confirmed the bit error rate for the link among the link demark endpoints and completed the acceptance test plan. I made necessary assumptions related to site access which was present and granted accordingly. I obtained microwave link demarcation endpoints connectivity using the technical expertise.

[CE 2.12] I did the multi-vendor installation, commissioning, and integration which included hot cutover and link migration. I executed the commissioning and installation of microwave links which was followed with diplexers installation. I worked on new feeder cables installation with the link planning and it was linked with sight survey line. I utilized appropriate logistics and carried out the complete testing and commissioning. I applied the full and partial site decommissioning services along with reactive and proactive maintenance.

[CE 2.13] Problem: The technical glitch was faced related to the fine alignment of ODU and the scenario was analyzed using the telecommunication engineering knowledge.
Solution:I carried out ODUs fine alignment which was linked at both ends and these were mainly worked with attaching the antenna from the direct mounting. I did ODU powering and carried out the whole transmission process which was followed with ensuring the far end transmitter frequency specifically matched with the local receiver frequency.

D) Summary

[CE 2.14] There were various scenarios faced during the installation and commissioning of the microwave link antenna. I made an evaluation of each step and it was linked with the appropriate installation of the antenna mainly worked with the usage of telecommunication engineering skills. I split the technicalities into several sections and accomplished the project results within the set work timeline.

CAREER EPISODE 3

Troubleshooting Restoration of Major Node

A) Introduction

[CE 3.1]

Title: Troubleshooting Restoration of Major Node

Duration: [Date] – [Date]

Location: Nairobi, Kenya

Position: Field Engineer

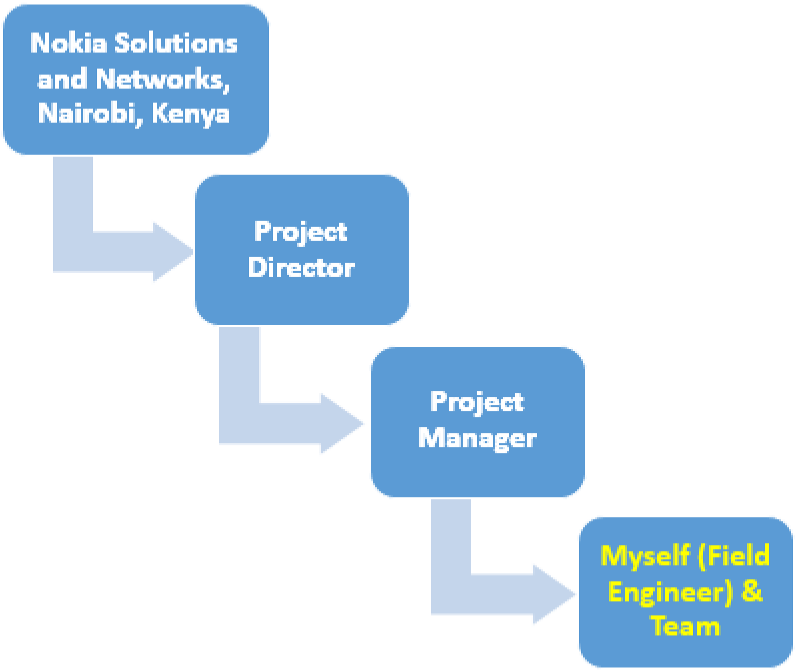
B) Background

[CE 3.2]The consideration is made on the mixed-integer programming model based on taking account restoration requirements analysis along with other hardware constraints. It works in abstracting from the specific failure and restoration protocol situation. This assisted in providing new structural insight into the network restoration issue and showing the mathematic viewpoint. Link Restoration, Reservation, and Path Restoration are the most common restoration techniques.

[CE 3.3] The work aim was executing the branch and cut framework for troubleshooting operation and restoration of a major node. I evaluated the algorithm process which included pricing problems based on computational complexity investigation. I executed the abstraction from the specific restoration protocol which turned out to be adequate from the computation viewpoint. Also, I carried out an investigation that indicated the global and local restoration rather than a path, link, reservation, and mixture restoration.

[CE 3.4]The project implementation was tested on 14 different real-world instances which worked with computational results mainly consisted of optimal network cost values comparison utilizing varied restoration mechanisms. I applied it mainly for securing the single node failure and discrete cost structure effects were investigated. Also, I made an appropriate investigation on the cost difference among successive and joint working along with spare capacity optimization. I compared the network restoration issues when getting the computational results and these were compared for both solution time and quality.

[CE 3.5]



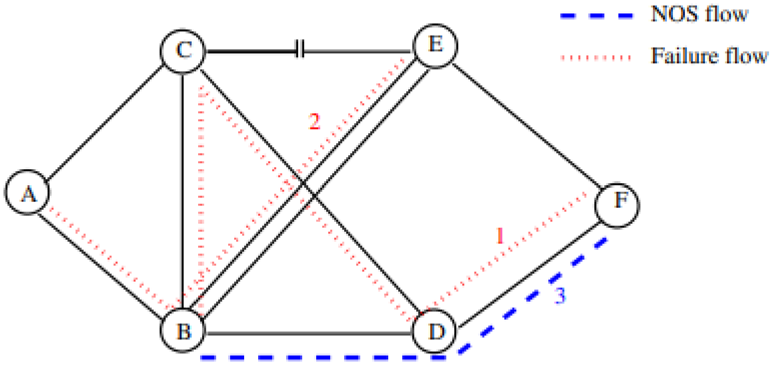
[CE 3.6] Project Duties:

- I applied telecommunication engineering skills for real-world network testing and the algorithm process was executed for computational complexity analysis mainly associated with restoration technique.
- I did work results computation mainly based on optimal small networks cost execution and carrying out an analysis against single edge failures.
- I did path restoration technique utilization in which the flow of NOS mainly rerouted from source to target.
- I made link restoration technique implementation in which scheme was executed for local rerouting and it specified termed as span restoration.

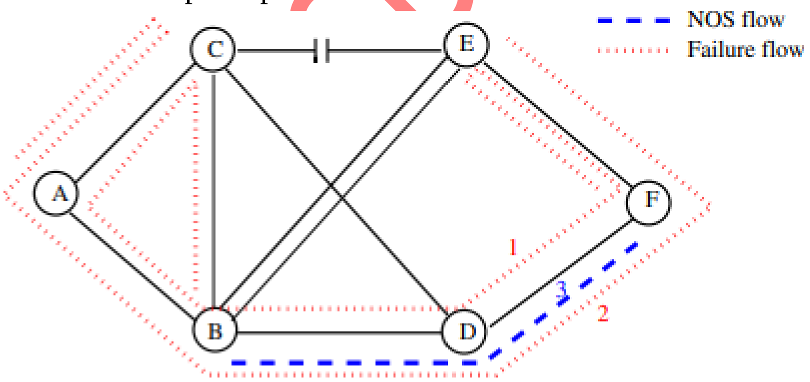
C) Personal Engineering Activity

[CE 3.7] I executed the model mainly consisted of edge cost technique and it took into account the node and edge capacity mainly exhibiting the non-linear behavior. I analyzed the cost structure with the scale economies' reflection. There was the assumption made on computational results and the model implementation worked with the network planning software. It indicated that the particular restoration mechanism abstraction greatly worked with model implementation. I tested the real-world network and the algorithm process was utilized for analyzing the computational complexity for varied restoration techniques. I computed the results which consisted of an optimal small network cost comparison mainly provided when obtaining security against single edge failures. I combined the restoration mechanisms link with path restoration for all single node failures in a simultaneous manner. Furthermore, the discrete cost structure counterintuitive effects worked on the installable capacities which were investigated accordingly. I made a comparison on dense networks which were for densely solving the functions and getting the correct solutions. It included a joint comparison with successive NOS which worked with spare capacity optimization.

[CE 3.8]I utilized a path restoration technique in which NOS flow was rerouted from source to target of the specified interrupted paths. There was no touching of the unaffected NOS routing path and it worked as a special global rerouting case where cost minimization was needed overall routings. I executed the technique which did not yield a lower cost than reservation.



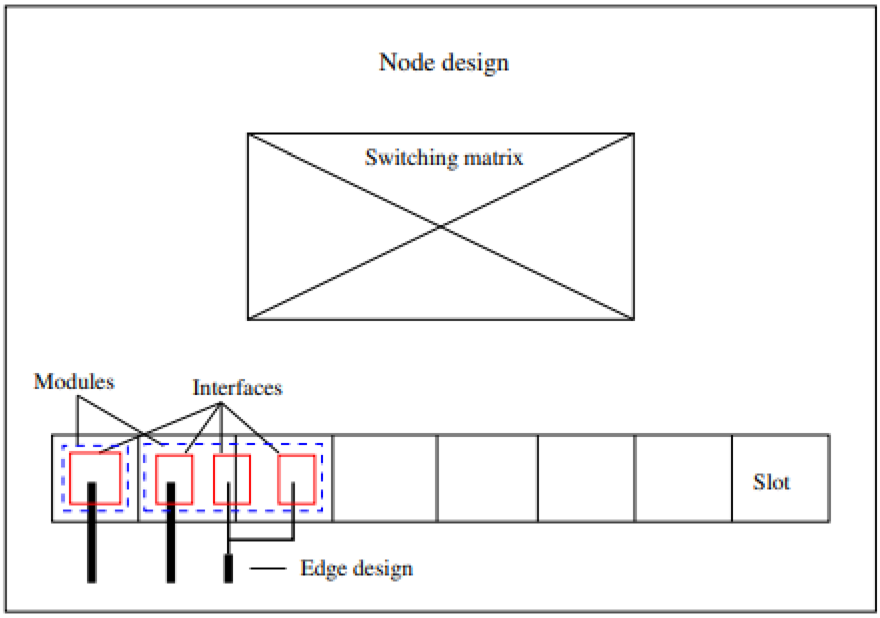
[CE 3.9] I implemented the link restoration technique in which the local rerouting scheme was executed specifically termed as span restoration and was designed for edge failures. I routed the affected path among the two end nodes upon edge failure and a new demand was created among u and v. It was equivalent to the total NOS flow demand value and this demand was routed among the failing edge end nodes. The resulted path was utilized for interrupted paths restoration and was concatenated with the local failure path with the NOS paths parts which did not fail.



[CE 3.10] I noted that the feasible link restoration routing was specifically for the path restoration and the backup paths were fixed to the corresponding NOS paths on the network intact. It resulted in directly implying the least expensive technology for path restoration. I noted that when the capacity was not reserved from the defined path linked with local failure paths, link restoration worked as path restoration with stub release concept. It indicated the practical result when carrying out computational activities and another reason was based on identifying the issues based on suggesting a global restoration scheme. It had affected paths from end to end restoration and local restoration schemes worked only the affected paths. Thus, I reserved the global and local restoration techniques for restoration mechanisms.

[CE 3.11] I executed the meta-mesh strategy in which link restoration modification was done with combining degree-2-chains linked with a single edge and applying link restoration among degree 3 or more nodes. With this effect, there was an avoidance obtained on the backhauling issue to a great extent which in turn resulted in required spare capacity reduction on degree-2-chains. I executed the method which worked in numerous restoration mechanism technique and it worked as link restoration. But, the affected paths were rerouted rather than end-to-end, meta-mesh local restoration scheme.

[CE 3.12] There were various components taken into consideration which included edge designs, node designs, and modules mainly connected via interfaces. I analyzed the working on the parts which mainly illustrated the connection among hardware components. I equipped the node in the network which provided with the maximum capacity for which the node was able to switch among the adjacent edges. I worked on the node design which offered few slots and these were equipped with modules in which each module occupied more than one slot. There were some interfaces provided from the module which in turn required to accommodate edge designs. I installed the edge design which provided upper bound capacity for the edge flow. The hardware configuration is below:



I worked on excluding the paths with loops in the model and it indicated the initial issues with link restoration. There were link restoration issues mainly associated with the backhauling effect for containing loops. Thus, I obtained no contradiction to the model with the failure routing paths utilized in the model for end nodes connection of a failing edge. It safely disallowed loops and occurred upon a concatenation of failure path with the NOS corresponding paths. I analyzed the paths which indicated the concatenation and the model contained NOS routing paths which were loop-less linked with failure routing paths. I dealt the path with the solution of post-processing value and aggregation of commodities worked with NOS. The failure commodities consisted of one demand in which there was the usage of an aggregated commodities form. I calculated the vortex cover in the demand graph and all demands were covered from the same node into one commodity. This resulted in allowing the demand constraints formulation and often led towards a significant reduction in linear programs sizing. There was no such aggregation in the model for the formulation of hop limits for NOS paths and it worked for the flow saving constraints.

D) Summary

[CE 3.13] All the defined project objectives mainly related to the troubleshooting of major node along with analyzing the related aspects. There was constant discussion made with the team members and evaluated the work results within the set deadline. I implemented the working on the project using my telecommunication engineering concepts and accomplished the work results within the specified project timeline.

PROFESSIONAL ENGINEER

Summary Statement

These are the competency Units and Elements. These elements must be addressed in the Summary Statement (see Section C). If you are applying for assessment as a Professional Engineer, you will need to download this page, complete it and lodge it with your application.

Competency Element	A brief summary of how you have applied the element	Paragraph number in the career episode(s) where the element is addressed
PE1 KNOWLEDGE AND SKILL BASE		
PE1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	All the related work activities linked with telecommunication engineering domain successfully accomplished within the specified work timeline.	CE 1.3, CE 2.1, CE 3.3, CE 3.4
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline	The adequate expertise in the telecommunication engineering domain was applied for obtaining the associated work results.	CE 1.6, CE 2.8, CE 3.6
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	There was appropriate research being made on the telecommunication engineering concepts and accomplished the work results within the set timeline.	CE 1.9, CE 2.10, CE 3.9
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	I researched on knowledge development principles and research directions were applied for getting the desired work results.	CE 1.10, CE 2.11, CE 3.10
PE1.5 Knowledge of contextual factors impacting the engineering discipline	I made contextual factors analysis based on impacting the engineering concepts and obtaining the work results using telecommunication engineering skills.	CE 1.11, CE 2.12, CE 3.8

PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline	I understood the contemporary engineering concepts with the norms, principles and scope brought into consideration for getting the desired project results.	CE 1.12, CE 2.6, CE 3.11
PE2 ENGINEERING APPLICATION ABILITY		
PE2.1 Application of established engineering methods to complex engineering problem solving	I obtained solution of complex engineering issues and achieved the associated work results using telecommunication engineering concepts.	CE 1.12, CE 2.10, CE 3.12
PE2.2 Fluent application of engineering techniques, tools and resources	I applied fluent telecommunication engineering concepts understanding and achieved the project results accordingly.	CE 1.11, CE 2.11, CE 3.11
PE2.3 Application of systematic engineering synthesis and design processes	I researched on systematic engineering concepts and designed processes were analyzed specifically for obtaining the targeted work results.	CE 1.9, CE 2.8, CE 3.10
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	I carried out systematic research linked with telecommunication engineering principles for getting timely work results.	CE 1.12, CE 2.10, CE 3.12
PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES		
PE3.1 Ethical conduct and professional accountability	I worked on consistently maintaining the ethical activities linked with the project for getting the timely results.	CE 1.10, CE 2.9, CE 3.8
PE3.2 Effective oral and written communication in professional and lay domains	I followed the written and oral communication skills in the work which helped adequately for getting the defined work results.	CE 1.8, CE 2.7, CE 3.10
PE3.3 Creative innovative and proactive demeanour	I applied the creative project related activities utilization which was linked with project for obtaining the timely work results.	CE 1.9, CE 2.10, CE 3.11
PE3.4 Professional use and management of information	I executed telecommunication engineering concepts implementation which was linked with other related factors for getting the associated project results.	CE 1.12, CE 2.12, CE 3.9
PE3.5 Orderly management of self, and professional conduct	I applied appropriate and systematic conduct in the work dependent on the telecommunication engineering concepts.	CE 1.7, CE 2.8, CE 3.7
PE3.6 Effective team membership and team leadership	I consistently understood the team membership concepts and carried out my responsibilities when working with the team under the senior management guidance.	CE 1.11, CE 2.11, CE 3.12