# Introducing Digital O&M capabilities in SEC-NG Fiber Network to enhance Operational Efficiency & Agility

*Muhammad Ali Malik\* & Mohammed S. Al-Otaibi*

*\*Huawei Tech. Investment Saudia Arabia Co.Ltd (muhammad.malik@huawei.com)*

*Saudi Electricity Company – National Grid Saudi Arabia (MSOtaibi2@ngrid.sa)*

*Abstract -* **Nationwide Fiber Optics Networks Deployment & their O&M is always a CAPEX & OPEX exhaustive & fieldwork intensive challenge for any Power Company and with its typical ROI projected over decades, it is imperative to focus on TCO and Operational Efficiency Improvements. This paper provides SEC-NG's approach of introducing digital transformation by leveraging OSS capabilities to enhance Operational Efficiency in Fiber Optics Network O&M. It also provides study related to efficiency comparison between traditional Fiber Optic O&M tasks & their equivalent digitized & automated task realized via deployed SEC-NG OSS, as a key enabler for achieving Operational Efficiency & Agility.**

   *Key Words –* SEC NG Fiber Optics Network, SEC NG OSS, Digital Transformation, Digital Operations, Operational Efficiency, Operational Agility.

## I. INTRODUCTION

Saudi Electricity Company (SEC) was established in the year of 2000. SEC is the biggest Utility Company in MEA & the only Electric Power Utility in the Kingdom Of Saudi Arabia and covers Power Generation (50+ GW), Transmission (60,000+ Km), and Distribution (500,000+ Km). SEC supply power to approximately 9.4+ million customers with annual growth of (~ 6-8%) 500,000 customers/year. National Grid (NG) is wholly owned by Saudi Electric Company (SEC) established in 2012. NG is responsible for operating and maintaining the electrical grid, continuing its reliability and stability to ensure the transmission of electric power to load centres across the Kingdom from all connected power plant and renewable sources. NG deploys and maintains nationwide 73,000+ KM Fiber optic cable/OPGW network to provide connectivity to DWDM and SDH networks to ensure communication among all SEC infrastructure and also to lease this to different Industry Users as Dark Fiber. NG OSS is utilized as a key enabler for digital transformation & for achieving Operational Efficiency and Agility in maintaining such massive Fiber Optic Cable (FOC) network. This is also the focus of this technical paper to study efficiency comparison with traditional means of managing such massive FOC networks.

## II. FOC O&M – DIGITAL VS TRADITIONAL O&M

Traditional FOC O&M has always been resource exhaustive field services, requiring an extensive amount of field teams and resources to cover the O&M requirements of FOC network while keeping up with the required Service Levels. Traditional FOC O&M methodologies & processes being utilized for Fault Demarcation are pre-dominantly manual in nature and relies heavily on On-Site traditional tools availability e.g. OTDR, Optical Power Meters, LASER Source etc. & experience of On-Site Field Teams to effectively utilize these tools in given circumstances every time to be able to demarcate fault quickly & accurately.

While considering the fact that this Traditional FOC O&M approach is currently the most widely used FOC O&M approach among the industry; it is still the most OPEX & field resource exhaustive methodology with little agility, accuracy and efficiency. With SEC-NG maintaining 73,000+ Km of nationwide Fiber Optic Cable network in KSA and providing Mission Critical Services to State Grid as well as to Business Users, it was imperative to find a more agile, automated and digitized way of performing FOC O&M then to solely rely on traditional FOC O&M methodologies.

This paper discusses the Digital Transformation approach being adopted by SEC NG in FOC O&M Fault Demarcation by deploying RFTS & its integration with OSS and its operational

baselines comparison to identify the expected Operational Efficiency & Operational Agility improvements to benefit the bottom-line.

### A. Operational Baselines for Traditional FOC O&M

Traditional FOC O&M follow the sequence of below-mentioned standard steps which are pre-dominantly manual in nature, complex by design, and time-consuming at the same time. Operational Baselines which are mentioned are based on operational experience of delivering similar scope FOC O&M projects in KSA and may vary based on scope, design, and area.

Traditional FOC O&M process flow starts with the identification of Fault over the Fiber Network by means of Network Surveillance and then demarcating the fault to be either Fiber Equipment Level Faults or FOC Level Faults from NOC. Once FOC Faults are demarcated by NOC, these Trouble Tickets are dispatched to OSP Field Teams to Identify the Fiber Fault Location and then start the restoration of the FOC fault. Scope of study in this paper is focused on Fiber Network Fault Identification, FOC Fault Demarcation & FOC Fault Location Identification as covered in Step-1 to Step-5 in below table-1.

TABLE I
Baseline Statistics for traditional FOC O&M [1]

| Steps | Key Tasks | Avg Time to Complete (min) |
|---|---|---|
| 1 | NOC - Fiber Network Faults Identification | 15 - 30 |
| 2 | NOC - FOC Fault Demarcation | 15 - 30 |
| 3 | FM - Resource Dispatch (2 x Teams) | 30 - 60 |
| 4 | FM - Time to Arrive at Test Points | 60 - 120 |
| 5 | FM - FOC Fault Location Identification | 120 - 360 |

### B. SEC-NG OSS - RFTS Overview

SEC-NG with massive task of managing FOC O&M for 73,000+ Km of cable nationwide in KSA, needed to transform traditional FOC O&M process into Digital FOC O&M process which relies on implementation of RFTS & its integration with OSS to enable agile Digital Operations tasks from NOC related to Auto-Fault Identification & Diagnosis for FOC related faults and RFTS functions to determines automatically FOC Fault Location i.e. Distance-To-Fault measurements from CO.

RFTS deployment typically consists of RFTU, FOMR, & associated LAN / WAN and OSS network as shown in below picture-1 for reference. Actual deployment models will vary based on use scenarios i.e. P2P, P2MP, WDM, GPON etc. and specific design requirements & objectives. RFTS solution normally relies on injecting Test Wavelengths (typically 1650 nm [2] which are different from Service / Traffic Wavelengths) within FOC path using RFTU Units and selecting different fibres using FOMR. RFTU live test results are always compared with Reference or Benchmark OTDR Curve stored in the system during commissioning phase and always serves as reference to compare and determine any dynamic changes in optical loss, attenuations, or new reflections which are indicative of Fiber Cuts, Fiber Losses, & Fiber Optical Performance Degradations.

With Digitized FOC O&M function realized via the deployment of RFTS and its integration with OSS solution; automated & proactive/predictive fault management is achieved in addition to automated Fault Demarcation & Fiber Fault Localization as highlighted in table-2.

PICTURE I
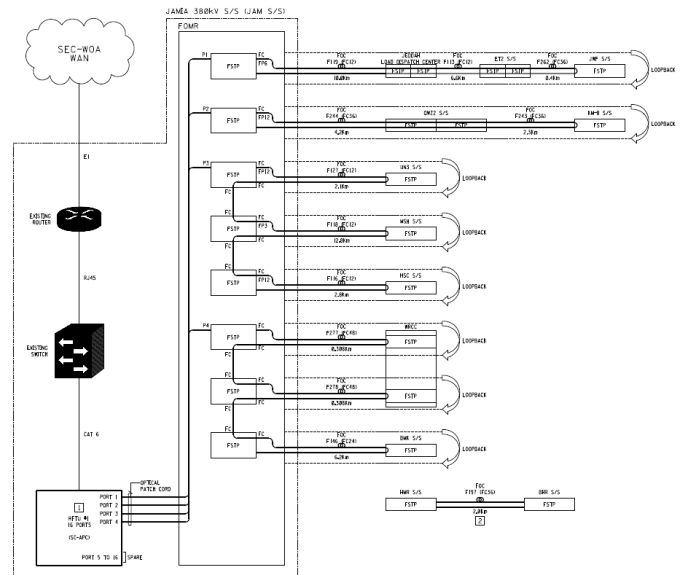Typical Deployment Model for RFTS in NG [3]



TABLE 2
Operational Statistics for FOC O&M with RFTS [4]

| Steps | Key Tasks | Avg Time to Complete (min) |
|---|---|---|
| 1 | RFTS - OSS Assisted Fault Identification & FOC Fault Demarcation | 2 - 5 |
| 2 | RFTS - OSS Assisted FOC Fault Location Identification. (Distance-To-Fault measurements) | 3 - 5 |

### C. Operational Efficiency & Agility Comparison

Traditional FOC O&M related 5 x process steps have been successfully transformed into 2 x Digitized process steps leveraging the RFTS Digital O&M functionalities & its integration with OSS as part of SEC-NG Digital Transformation initiatives. This not only enhances the

Operational Efficiency but also drastically improves the accuracy, quality and conformance of processes being transformed from manual to digitized operations.

Below table-3 highlights the Operational Efficiency Improvement achieved by digitally transforming the FOC O&M processes and thus optimizing the process in terms of reduced & digitized operational steps, enhanced process quality & accuracy.

TABLE 3
Operational Efficiency Improvement Comparison

| Traditional FOC O&M | | Digital FOC O&M | |
|---|---|---|---|
| Steps | Key Tasks | Steps | Key Tasks |
| 1 | NOC - Fiber Network Faults Identification | 1 | RFTS - OSS Assisted Fault Identification & FOC Fault Demarcation |
| 2 | NOC - FOC Fault Demarcation | | |
| 3 | FM - Resource Dispatch (2 x Teams) | 2 | RFTS - OSS Assisted FOC Fault Location Identification. (Distance-To-Fault measurment) |
| 4 | FM - Time to Arrive at Test Points | | |
| 5 | FM - FOC Fault Location Identification | | |
| ~ 60% Process Optimization & Operational Efficiency Improvement Achieved | | | |

In addition to Operational Efficiency improvement achieved by digitizing and automating the processes, there is also drastic improvement in Operational Agility in terms of executing the process.

Below table-4 highlights the Operational Agility improvement achieved by digitally transforming the FOC O&M process thus optimizing Cost baseline as well as reduced MTTR for Fiber Faults Restoration.

TABLE 4
Operational Agility Improvement Comparison

| Traditional FOC O&M | | | Digital FOC O&M | | |
|---|---|---|---|---|---|
| Steps | Key Tasks | Avg Time to Complete (min) | Steps | Key Tasks | Avg Time to Complete (min) |
| 1 | NOC - Fiber Network Faults Identification | 15 - 30 | 1 | RFTS - OSS Assisted Fault Identification & FOC Fault Demarcation | 2 - 5 |
| 2 | NOC - FOC Fault Demarcation | 15 - 30 | | | |
| 3 | FM - Resource Dispatch (2 x Teams) | 30 - 60 | 2 | RFTS - OSS Assisted FOC Fault Location Identification. (Distance-To-Fault measurment) | 3 - 5 |
| 4 | FM - Time to Arrive at Test Points | 60 - 120 | | | |
| 5 | FM - FOC Fault Location Identification | 120 - 360 | | | |
| ~ 98% Operational Agility Improved in term of Reduced Execution Time (i.e. Time to Complete a Task). Reduced MTTR for Fiber Cable Fault by ~ 4 - 10 Hrs. | | | | | |

In order to estimate the expected OPEX saving Per FOC Fault to be achieved with this Digital Transformation; below mentioned operational cost baseline in table-5 is utilized and OPEX saving Per FOC Fault is estimated. This operational cost baseline is based onoperational experience of delivering similar scope FOC O&M projects in KSA and may vary based on scope, design, and area.

TABLE 5
Expected OPEX Saving with Efficiency Improvement [5]

| Resources | Hourly Operational Baseline Estimate - SAR |
|---|---|
| Skilled NOC Engineer | 212 |
| 2 x Equipped Field Teams | 505 |
| Estimated Hours Reduced | Hours |
| NOC | 0.9 |
| FM Teams | 8.9 |
| Estimated OPEX Savings Per FOC Fault via Digital Transformation | |
| ~ 4,683 SAR | |

Revenue Loss Saving achieved with reduced MTTR by 4 – 10 hrs. for FOC related Faults, Reduced Customer Churn Cost and Reduced SLA penalties Cost savings are not yet considered in above estimations and are also in-direct benefits of this digital transformation.

### III. CONCLUSION

The objective of Digital Transformation within O&M domain or as a matter of fact in any Transformation is to enhance Operational Efficiency by means of optimizing the legacy Processes and making them Automated, digitized & Agile Processes; thus targeting Operational Excellence and improving the bottom-line.

These aspects have been realized in Digital Transformation in SEC-NG by means of RFTS deployment & its integration with OSS thus introducing Digital O&M capabilities in FOC O&M domain. As elaborated above, around ~ 60% Operational Efficiency Enhancement & ~ 98% Operational Agility Enhancement is achieved with an estimated OPEX saving of around 4,683 SAR per FOC Fault.

### IV. RECOMMENDATION

With a strong foundation already laid with Digital O&M capabilities for FOC O&M within SEC-NG, it is recommended to eventually evolve towards enabling predictive & autonomous Digital O&M by means of introducing BIG Data & AI capabilities to achieve next level of Digital Transformation.

## V. Acronyms

AI     : Artificial Intelligence
CAPEX  : Capital Expenditures
CO     : Central Office
DCN    : Data Communication Network
DWDM  : Dense Wavelength Division Multiplexing
EMS    : Elements Management System
FM     : Field Maintenance
FOC    : Fiber Optic Cable
NG     : National Grid
NOC    : Network Operations Center
ODF    : Optical Distribution Frame
ODN    : Optical Distribution Network
FOMR  : Fiber Optics Management Rack
OPEX  : Operational Expenditures
OSS    : Operations Support Systems
OTDR  : Optical Time Domain Reflectometer
O&M   : Operations & Maintenance
GPON  : Gigabit Optical Passive Network
GW    : Giga Watts
P2P    : Point 2 Point
P2MP  : Point 2 MultiPoint
RFTS   : Remote Fiber Testing System
RFTU   : Remote Fiber Testing Unit
ROI    : Return on Investment
SDH    : Synchronous Digital Hierarchy
SEC    : Saudi Electric Company
TCO    : Total Cost of Ownership
WDM   : Wavelength Division Multiplexing

## VI. Acknowledgment

The authors gratefully acknowledge the contributions of NG Telecom Engineering Department & NG Telecom Technology Services & App Division for sharing required information for this paper.

## VII. References

[1] *Huawei Industry Experience – Typical Operational Time Baseline Statistics for traditional FOC O&M related tasks within KSA.*

[2] *ITU-T Recommendation L.41 - Maintenance Wavelengths on Fibres carrying signals*

[3] *SEC-NG RFTS Typical Deployment Model Reference.*

[4] *SEC- NG BOSS Team Operational Reference for RFTS integration with OSS.*

[5] *Huawei Industry Experience – Typical Operational Cost Baseline Statistics for traditional FOC O&M related tasks within KSA.*

## VIII. Biographies

1st Author

**Mr. Muhammad Ali Malik** bring with him rich, diverse & extensive industry experience in O&M and Delivery & Services domains; while working in Top ICT Companies in the Middle East & Asia Region as well as also being a part of Huawei in several Representative Office including Qatar Office, M.E Region Head Quarters & Suadia Arabia Office; in several Senior Management Roles. He is B.E Electrical Engineering with M.E in Engineering Management with keen focus on Transformation Management, Total Quality Management, & Organizational Change Management. He has also been part of Huawei Senior Leadership Development Program along with his previous engagements in Industry Leadership & Executive Development Programs. He has successfully orchestrated & implemented several of the complex Digital Transformation & Operational Transformation projects in M.E Region. He is currently serving in Huawei Saudia Arabia as Head of Delivery & Services – Utility Sector and is one of the top O&M and Services experts for Huawei in M.E Region.

2nd Author

**Mr. Mohammed Saleh Al-Otaibi** is Director of Telecommunication Department at National Grid SA of Saudi Electric Co. He is B.E Electrical Engineering & M.E in Electrical Engineering with keen focus on Business Process Re-Engineering & Organizational Development. He served KAUST in 2003 then joined SEC in 2004 and has served in different management positions as Manager Line & Telecom Specifications, Acting Director Standard & Specification, and Acting Director Telecom Engineering. He has been leading member of various committees for Leadership Development Programs, Organization Restructuring, Project Forecasting, Economic Feasibility & Risk Studies. He successfully implemented many management initiatives in domains related to Business Solutions, Capacity & Inventory Planning, and efficient delivery of optical services in Telecom department. He orchestrated digital transformation program of NG Telecom Network Operation and achieved successful implementation of OSS in Network Operations Center (NOC) and Cyber Security Operation Center (CSOC).