

 Eskom	Standard	Technology
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SYSTEM USER REQUIREMENTS
SPECIFICATION**

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1. Introduction

Eskom has an extensive fibre optic network overlaid on its power transmission and distribution networks with nationwide coverage. There is a requirement to manage the fibre optic network in order to for Eskom to maximise the value that can be derived from this asset. This will also be an enabler for Eskom's Smart Grid Strategy.

2. Supporting clauses

2.1 Scope

This document covers the minimum requirements that the end users have for an fibre management system which covers both fibre optic cores and fibre optic cables.

2.1.1 Purpose

The requirements stated in this document shall be used for testing the market for an fibre management system.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001, Quality Management Systems.
- [2] 240-86458714 Generic Network Management Specification Standard
- [3] 240-89335081 Telecommunications Transport Network Roadmap
- [4] 240-4620188 Fibre Optic Roadmap
- [5] 240-106192711 Technology Roadmap for Telecoms Operational Support Systems

2.2.2 Informative

- [6] RFP-852 Scope of Work, Fiber Optic Network Asset Management Software, City of Ann Arbor, Michigan, March 2003
- [7] Scope of Services, Enterprise Asset Management System, City of Merriam, Kansas, June 2013

2.3 Definitions

2.3.1 General

None

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
CAD	Computer Aided Drawing
GIS	Geographic Information System
OTDR	Optical Time Domain Reflectometer
OTN	Optical Transport Network
SDH	Synchronous Digital Hierarchy

2.5 Roles and responsibilities

The following are the roles and responsibilities for the implementation of this document.

Role	Responsibility
Eskom Telecommunications	Responsible for the implementation, operation and maintenance of the network management systems.
SCOT Telecommunications Study Committee	Responsible for establishing the standards that govern the implementation of the network management systems.
Telecommunications Technology Centre of Excellence	Responsible for establishing contracts and testing of new technologies with the assistance of customers and Eskom Telecommunications.
Customers	Responsible for providing the current and future requirements. Customers shall update their requirements whenever there are changes.

2.6 Process for monitoring

Eskom Documentation Management process shall apply in ensuring that this document stays current.

2.7 Related/supporting documents

Not applicable.

3. Fibre Optic Asset Management System

Most recently the use of Eskom's fibre optic network has expanded and has opened communications corridors for smart grid applications. Eskom deems its fibre optic asset essential and therefore requires accurate up to date information of its fibre optic network. Maintenance, inventory management and tracking of these assets are a requirement in maintaining this critical infrastructure.

3.1 Challenges

Currently, fibre optic network associated attribute data, are held in various types of CAD drawings, as-built drawings, spreadsheets, and word processing documents. In addition, some information may be based on tacit knowledge of current employees and human memory. There is limited amount of data in GIS, making it a challenge to manage. The OPGW fibre optic cable has mechanical, electrical and telecommunication information and all of these needs have to be captured and maintained correctly.

3.2 Opportunities

Eskom has invested significantly in GIS-based solutions to manage a wide-variety of Eskom owned assets (e.g., power generation and transmission and distribution assets). There is a need within the organisation to utilise a more dynamic, centralised, GIS-based solution that incorporates location of fibre optic network assets as well as real-time data pertaining to installed base. Integration to existing systems such as SmallWorld and ArcGIS can be beneficial in realising the long-term goals of Eskom.

3.3 High Level Requirements

3.3.1 Asset Management Requirements

3.3.1.1 Asset Data

a) The following are expectations of the Asset Management function of the system: The following list provides a non-exhaustive list of fibre optic asset data:

- 1) Overhead and underground cables and cores (Manufacturer, installed date, UTS, greased, etc)
- 2) Cabinets (name, layout, position, etc.)
- 3) Number of fibre optic cores (utilised, available, etc.)
- 4) Network points
- 5) mux-ponder equipment (e.g. multi-protocol, multi-rate)
- 6) Managed and unmanaged switches
- 7) Manholes
- 8) Joint Boxes
- 9) Splices
- 10) Serial modems
- 11) Repeater sites
- 12) Communication converters
- 13) Traffic controllers
- 14) Other miscellaneous fibre optic equipment assets

3.3.1.2 Inventory

- a) Support the inventory by allowing addition and management ability during the lifespan of the asset
- b) Allow documentation of connectivity (of fibre cores) of the complete fibre network assets.
- c) Provide ability to manage all fibre assets through a mapping interface with GIS locations.
- d) System must allow for new global attributes to be added during the system lifecycle

These may include:

- 1) Ownership of Line
- 2) Hyperlink to Electronic Test Results of line (archive).
- 3) Capacity utilisation (e.g. 18/24 or 08/48)
- 4) kA rating in cases on OPGW
- 5) Greased or Ungreased OPGW
- 6) Dome joint on insulated or uninsulated tower

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- 7) Dome Joint T-Off with core distribution
- 8) Colour of HDPE pipe for DUCT cables
- e) Allow for a functionality to globally populate a field across all asset types.
- f) Allow for assets to be queried or sorted based on a or combination of attributes.
- g) Ability to provide a GIS view of selected fibre assets as per user selections (e.g. all joint boxes on a HV line).
- h) Provide ability to select work orders and inspection records from a GIS selection (e.g from a particular HV line or area/Grid)
- i) Provide ability to attach general images and documents to an asset record as well as tagging with GIS locations.
- j) Ability to provide historical information such as previous type of OPGW installed or faults logged.

3.3.1.3 Asset Inspections

- a) Provide ability to store inspection record and images for multiple asset inspections
- b) Provide ability to apply a condition assessment rating to an inspection found defect
- c) Provide ability to query/sort assets based on condition ratings
- d) Provide ability to create a condition rating report

3.3.1.4 Inventory/Parts

- a) Provide ability to include vendor and manufacturer information with a part
- b) Provide ability to store manufacturer and vendor history.

4. Fibre Optic Network Management System

Currently, Eskom has not deployed an active fibre optic network management system. Resulting in breakdown rather than proactive maintenance of the fibre network, faults are actively identified through failures in the SDH network, however the pinpoint location of the fault is left to the field personnel to identify through the use of OTDRs and walk-downs.

4.1 Challenges

Breakdown maintenance means that for the duration of the fault, there is a possibility of services being affected, especially where the alternate/backup route is on microwave radio with capacity lower than that on the fibre route. Also, OTDR trace files are not managed regionally by the different field teams, there is no platform or system to feedback these to the network management centre. The network management centre (NMC), therefore has no direct view of the condition of the fibres on which they provision services on. Discrete records are kept for the allocation of the fibre cores to customers/services, these are not centralised and also the NMC has no view of it.

4.2 Opportunities

Eskom is looking at investing in an Optical Transport Network (OTN). The system should be able to leverage on the advanced management features that are supported by OTN. These include (but not limited to):

- Path Monitoring
- Trail Trace
- Backward Defect Indication
- Backward Error Indication and Backward Incoming Alignment Error

- Tandem Connection Monitoring
- Fault Type and Fault Location reporting

4.3 High Level Requirements

At minimum, the network management system shall comply to the requirements stated in: [240-86458714 Generic Network Management Specification Standard](#).

4.3.1 General Network Administration Requirements

- 1) Data Management
 - a) Provide ability to view detailed connection and splice modelling
 - b) Calculate circuit/fibre distance between two points including twist factor, index of refraction, and fibre ring configurations
 - c) Store attenuation losses, including splice and mated-connector losses
 - d) Ability to hierarchically list fibre assets from map regions to signals on a cable
 - e) Creation and visualisation of physical connectivity between the optical fibre
 - f) Data Speeds and Type (e.g., serial baud rate, Ethernet bit rates, etc)
- 2) Data Selection and Retrieval
 - a) Provide ability to display geographic views of the outside plant
 - b) Provide ability to display graphical views such as map view, schematic view, rack view, etc.
 - c) Support for address, plot, and/or landmark based search
 - d) Support for inventory (e.g., cable, joint, branch, etc) based search (inventory refers to data items defined in...)
 - e) Support for importing of assets from existing formats (ESRI.shp or .gdb, spreadsheet, Microsoft Access)
 - f) Support for graphics and text redlining
 - g) Support for query and analyse function:
 - 1) What is it?
 - 2) Where is it?
 - 3) Physical attributes and capacity?
 - 4) How is it connected?
 - 5) Project details
 - 6) Lifespan (installation date)
- 3) Map Functionalities
 - a) Ability to enter and select latitude/longitude coordinates in decimal degrees, X:Y coordinates, and/or degree minute second.
 - b) Support for zoom in/out, pan, full extent and view attributes.
 - c) Ability to export to a Google Earth KML format.

4.3.2 Fault Management Requirements

4.3.2.1 Fault Tracing and Visualisation

- a) Provide circuit provisioning and service remediation capability by creating and optimizing alternative routes in the event of fibre faults or fibre outages and mapping “what if scenarios” for extending and/or remediating services to customer on the network
- b) Provide ability to determine location of a fault using results of an optical time-domain reflectometer (OTDR) test
- c) Provide ability to trace distance from equipment port to location of fault
- d) Provide ability to trace from any point in any direction
- e) Provide ability to place a fault feature at a location
- f) Support for verification of physical connectivity:
 - 1) Cable to cable
 - 2) Strand-to-strand
 - 3) Calculation of circuit/fibre distance between two points including twist factor and fibre ring configurations

4.3.2.2 Preventive Maintenance

- a) Provide ability to set triggers for preventative maintenance by various criteria such as by date, hours, readings, or kilometres.
- b) Include appropriate labour, materials, parts, and other requirement work components.
- c) Set various preventative maintenance start date types, e.g. days, weeks, months, etc.

4.3.3 Performance Management Requirements

4.3.3.1 Reports

- a) Support for standard analysis and reporting of fibre optic assets
- b) Open standards reporting tool
- c) Allow users to create ad hoc reports
- d) Store ad hoc report queries and changes as required
- e) Review all reports before they are printed
- f) Include pre-defined general system reports that can be customized by the user
- g) Send reports to printer, file, or email
- h) Provide compatible file formats for exporting reports, (i.e .doc, .xls)

4.3.4 Fibre Optic Network Design Requirements

The system shall have the ability to support the planning, engineering design, analysis and maintenance of the optic fibre network with modelling for fibre, and other relevant equipment components, and accommodate the connectivity of the complete network from any terminating device to any termination point.

4.3.5 Work Order Integration Requirements

The system shall support key business processes for work orders, including integrating to current work order management systems (e.g., Workplace)

4.3.6 Field Automation Requirements

- 1) For network repairs, modifications, and extensions, field automation capabilities will allow Eskom to dispatch field crews with corresponding job information. The system shall support the ability for mobile field crews to:
 - a) Validate the physical network model to the digital network model
 - b) Capture inspection/status information about field equipment
 - c) Capture redlines against the digital network model representing as built changes
- 2) The system should support a mobile application for field staff to:
 - a) Access real-time data in connected mode,
 - b) Operate in disconnected mode with queued updates when appropriate.

4.3.7 Digital Image Management Requirements

- 1) The system shall be capable of supporting high-resolution imagery (both aerial and photo imagery), and/or shall be able to seamlessly interface with existing ESRI and SmallWorld geo-databases. This imagery will be used during network maintenance and field engineering operations to help understand the location and characteristics of the physical network.
- 2) The system shall be capable of supporting large volumes of asset imagery (high resolution, large coverage, multiple-time snapshots) with a high-performance image management and retrieval system for improved productivity and quick access to images when viewing fibre optic assets in a mapping interface (i.e., images and photos geo-coded and pinned to the appropriate fibre optic asset).

4.3.8 Enterprise Sharing Requirements

The system shall be able to provide tools to share the most recent information on the physical network and its attributes. These include desktop viewing and analysis tools linked to the central geo-database, as well as intranet portals that may include dashboard and executive business intelligence information.

5. Authorization

This document has been seen and accepted by:

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6. Revisions

Date	Rev.	Compiler	Remarks
March 2023	2	V Naidu	Additional information added such as KML format and other data requirements
Sept 2016	1	B Shezi	User Requirements Specification required for Optic Fibre Management System

7. Development team

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8. Acknowledgements

Not applicable.