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1	A specific plant, project or solution	
2	A mature and stable technical area/technology	
3	Established and accepted practices.	x

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Content

Foreword

Not applicable

Revision history

This is a new document.

Date	Rev.	Compiled By	Clause	Remarks
Nov 2012	Rev 0	P Groenewald		Included comments from S Laher. Document number added for TGC sign-off. Included comments from TGC.
Oct 2012	Final Draft 1H	P Groenewald		Included final revisions by P Groenewald, R McCurrach, Rob Stephen, Rosalette Botha, Ken Hales and input by P Moyo and W Majola.
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Sept 2012	Draft 1F	P Groenewald		Updated as per agreed Joint OT/IT Governance and , input from E Johnson, S Lennon, S Laher. IT Risks in OT Environment forum influence. Reviewed document title and updated content in line with a Practice Note.
Oct 2011	Draft 1A	D Gütschow		First draft

Applicability

This document shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

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Introduction

By and large, Operational Technology (OT) has been the realm of control and monitoring systems developed and supported by engineers responsible for maintaining the integrity and performance of Eskom's electrical plant and networks, and those responsible for real-time operation of the grid. Historically, due to diverse technologies, platforms and communication standards different OT and IT systems could not interface and standalone systems prevailed.

However, technology advancements combined with an increasing adoption of similar hardware and software platforms, infrastructure and common communication standards (convergence) are creating opportunities for increased interfacing, collaboration and data exchange between different OT systems, between different IT systems, as well as between OT and IT systems. Prior governance and collaboration practice is not adequately tuned to leverage the advantages available to the Eskom business as a result of this trend, nor to adequately manage the increased risk that this tends to bring.

This has led to the need for a more integrated OT / IT collaborative approach. This practice note defines OT and additional OT/IT accountabilities and governing principles to ensure collaboration and to promote appropriate convergence, while sustaining the integrity of Eskom's operational systems and adequately managing their risks.

Keywords

Operational Technology (OT), Convergence, Information Technology (IT), OT/IT collaboration

1 Scope

This document:

- defines Operational Technology (OT) in Eskom,
- clarifies accountability and governance for OT , and
- stipulates additional accountabilities and governance for IT and OT required to timeously establish the required degree of collaboration and convergence.

2 Normative references

Parties using this document shall apply the most recent edition of the documents listed below.

None

3 Definitions and abbreviations

3.1 Definitions

Information Technology (IT): Information Technology (IT) is a common term used to describe the entire spectrum of technologies used for corporate information processing including software, hardware and related services. It involves the electronic representation of business information that is processed by a computer or sent over a digital communications (e.g. IP) network.

Operational Technology (OT): Gartner defines OT as “physical-equipment-oriented technology”.

In essence OT is the technology that is used to operate, monitor and control the power system. For a formal definition of OT refer to par 5.1.

OT-IT convergence: The trend that:

- the underlying platforms and technologies used in IT and OT are increasingly the same,
- are increasingly using some shared infrastructure, standards and approaches,
- the shifting from proprietary, hardware-based to open, software-based technology,
- the evolution of new risks due to the above, and,
- that companies are increasingly leveraging these trends for increased business value.

3.2 Abbreviations

ADR	Architecture Design Review Committee
DRC	Design Review Committee
EARC	Enterprise Architecture Review Committee
IT	Information Technology
OT	Operational Technology
SCOT	Steering Committee of Technology
TGC	Technical Governance Committee

4 Applicability

This Practice Note is mandatory with immediate effect. This document will be adapted from time to time as required, as the review of Eskom's corporate strategy and functional IT, OT, technology and Smart Grid strategies evolve, and will ultimately be superseded by revisions of the relevant policy and procedure documents.

This Practice Note amends and adds to, and does not replace any accountabilities and governance defined elsewhere.

5 Eskom Operational Technology (OT)

5.1 Definition of OT

In the Eskom context Operational Technology (OT) is defined as:

O*perational systems* which form ***part of*** Eskom's ***plant / network assets***, and which could by virtue of design, maintenance or operation ***directly*** result in the failure of these assets to meet their ***purpose and performance criteria***, where:

- ***Operational systems:*** are all systems (including electronic, telecommunications and computer systems and components) which process, store or communicate operational data or information.
- ***Part of:*** means contribute to the asset meeting its purpose and performance criteria.
- ***Plant / network assets:*** are any part of the "built environment" utilized by Eskom to run its production, delivery and logistics processes, including generation, transmission and distribution of electricity, etc.
- ***Directly:*** means in real time or near real time. E.g. would include supervisory control systems, but would exclude spares ordering applications (even though these could eventually result in the failure of the asset).
- ***Purpose and performance criteria:*** The "design to", "maintain to" and "operate to" criteria that are generally specified formally.

Systems, sensors, transducers and Programmable Local Controller equipment, which extract signals and measurements from the plant / network asset or its control environment, or facilitate control over the these assets generally meet the above criteria and qualify as OT, since their failure could directly result in the failure of the plant / network asset or its ability to meet its purpose and performance criteria.

In some cases, obvious failures of ***operational systems*** may not directly result in the failure of purpose or performance of the ***plant / network asset***, but because of the way it is designed, normal operations or maintenance of the operational system could result in a risk to the plant / network asset. An example is:

- Voltage spike induced in a control circuit due to a lightning strike on the power supply of an IT server not fitted with the same spec of surge protection as used on the control circuit, and inadequate voltage supply decoupling (e.g. optical decoupling).

Such equipment generally meets the above criteria and qualifies as OT, since their design, operation or maintenance could directly result in the failure or impact of the plant / network asset or its ability to meet its purpose and performance criteria.

Annexure A contains a table of typical characteristics of OT, IT and joint OT/IT systems.

5.2 Governing Principles for IT and OT in Eskom

The following governance principles already apply, and are paraphrased here to set context and clarify intent:

5.2.1 All OT systems (as per above definition) shall follow the Engineering design, maintenance and operations review, quality and governance processes specified from time to time by the Technology Governance framework.

The purpose of this is to ensure integrity and quality of designs, and to ensure that designs conform to whatever technical standards have been promulgated by SCOT etc.

5.2.2 All IT systems shall follow the IT design, maintenance and operations review, quality and governance processes specified from time to time by the CIO.

The purpose of this is to ensure the integrity and quality of designs, and ensure that designs conform to whatever local and international IT standards, landscapes and enterprise architecture principles and design rules have been promulgated and implemented by Enterprise Architecture.

Note that both the above governance processes involve interventions at successive stages of solution design, from concept, through basic and detailed design, construction to deployment, as appropriate. Earlier stage reviews typically emphasize the inclusion of the respective overall standards, landscapes and design to criteria, and co-ordination / global optimization within the respective domains (OT and IT). Later stage reviews tend to emphasize the compliance of specific designs with overall standards, landscapes and rules, as well as quality of design. All stages also assess traceable alignment to business objectives, requirements and value propositions.

5.2.3 All OT standards, landscapes and design rules shall follow the governance processes specified from time to time by the Technology Governance framework, and particularly the SCOT process for technical standards.

The purpose of this is to ensure setting appropriate standards, landscapes and rules leading to a degree of global optimization, agility, “future proofing”, integration and co-ordination of the overall OT landscape.

5.2.4 All IT standards, landscapes and design rules shall follow the governance processes specified from time to time by the CIO, and particularly the EARC governance process.

The purpose of this is to ensure setting appropriate standards and rules leading to a degree of global optimization, agility, “future proofing”, integration and co-ordination of the overall IT landscape.

Line managers, project sponsors and project managers are required to ensure that in each domain (OT and IT), solutions must include compliance to both solution requirements and overall standards and design rules in their “design to” criteria. They shall also ensure that the IT and OT components of their projects follow the respective IT and OT governance processes, and contracts placed on external parties require such external parties to adhere to these processes.

5.3 Additional Governing Principles for IT and OT in Eskom

The following additional governance is hereby mandated:

Note: The purpose of this is specifically:

- to address and progress IT / OT collaboration, cross domain optimization, agility, “future proofing”, integration and co-ordination,
- to ensure the appropriate degree of convergence required to enable smart-grid and other convergence business value, and
- to ensure that consequential risks are adequately managed.

5.3.1 All OT systems and OT components of plant / network assets shall, in addition to Technology governance, adhere to the IT governance process already mandated for all IT systems.

5.3.2 All IT systems, shall, in addition to normal IT considerations, be assessed against the additional criteria in the “note” above.

5.3.3 All OT standards, landscapes and design rules which are promulgated shall adhere to the IT governance process (EARC) as well as SCOT approval and publishing.

5.3.4 All IT standards, landscapes and rules shall, in addition to normal IT considerations, be assessed against the additional criteria in the “note” above. To the extent that these IT standards, landscapes and rules apply to OT systems, they will also follow OT Governance.

5.3.5 IT Governance decision making pertaining to OT Systems (and components) will be based on a quorum of both IT and OT representation at the meetings. To achieve effective governance, the relevant IT Governance Committees mandates and terms of reference will define the required quorum from both the IT and OT areas.

5.3.6 EARC (or the EARC chairman), in consultation with relevant SCOT structures, is mandated to determine categories of OT solutions, standards, landscapes, specifications, etc. that need not follow IT governance. This may be amended from time to time to cater for ongoing convergence. Likewise, SCOT is mandated to determine categories of OT solutions, standards, landscapes, specifications etc. that need not follow the technical governance process. E.g. Access control or automated power management on office buildings may be excluded should the engineering function not deem it within its mandate to govern.

Note: The purpose of this is to ensure that the governance of already agreed pure OT systems is not hamstrung by additional, unnecessary IT governance. A list of these systems, standards, etc. categories will be kept and published by EARC.

5.3.7 Senior Managers from OT will attend EARC as principal members, and likewise Senior Managers from IT will attend the relevant technical governance committees. These principal members will be allocated by the DE Group Technology and the CIO.

5.4 Resolution of Conflicting Criteria

The following apply regarding resolution of conflict or necessary arbitration:

It is already the case that specific solutions, at the time of design review, bring to light the need to review existing standards, landscapes and design rules which may have become outdated due, for example, to evolving circumstances. In such circumstances the review of such standards, landscapes and rules are triggered, and the relevant governance body makes a judgement call or temporary condition w.r.t. the solution being reviewed.

The above shall now also apply, as standards, landscapes and design rules initially established within each domain (OT and IT) now become applicable across both domains.

In the event of any conflicts or where there is necessary arbitration criteria which cannot be resolved according to the above mechanisms, escalation will be to the CIO and the DE Group Technology (jointly) and finally if necessary to TGC.

5.5 Additional organizational accountabilities

Line managers, Project sponsors, Project managers, Engineers and Designers are required to ensure that solutions include compliance to the above additional requirements, and that contracts placed on external parties require such external parties to adhere to these additional requirements.

The Group IT Enterprise Architecture function and OT Technical Governance function (including the relevant SCOT and EARC forums) will collaboratively plan and implement the revision of the existing EA landscapes, OT technical standards, landscapes and design rules as required above, informed by the relevant technology, IT, Smart Grid, Telecommunications strategies, w.r.t. convergence.

Engineers, Enterprise architects and IT Professionals will collaborate on the design of solutions and establish effective networks to ensure that appropriate convergence is worked into solution designs.

All information security policies applicable to both IT and OT will be approved by the Information Security Compliance Committee, by the Senior Manager (Information Risk and Compliance) and follow the Eskom Security operating model and governance. Until this is in place, the Security Recovery Programme (SRP) will be the final body regarding all Eskom Security Policies, Projects, and decisions.

In addition to existing criteria, the assessment of additional risks due to convergence will be included in the respective risk registers of OT and IT.

The OT operations environment will continue to be accountable for business continuity, managing and reporting operational risks in the OT environment, and the IT function will continue to be accountable for business continuity, managing and reporting operational risks in the IT environment. Both of the above will continue to be done in conjunction with the business as appropriate.

Annex A: Typical characteristics of OT, IT and joint OT/IT systems:

Table 1: Typical characteristics of OT, IT and joint OT/IT systems:

	Operational Technology (OT) OT is about running the electrical network	**Information Technology (IT)** IT is about enabling the business	**Joint OT/IT** End to end business optimisation
Purpose / Role	Manage / monitor / control physical assets, plant and network equipment.	Process business transactions, provides communication, information, supports people, decision making and data.	End to end solutions => Convergence.
Architecture	Embedded hardware/software – application specific, purpose built substation Local Area Networks (LANs) and Wide Area Networks (WANs) for grid operations and engineering purposes.	Generic enterprise Local Area Networks, on site Network Edge IP Routing and Data Centre infrastructure and applications, MPLS, ISP.	Common Information Model (CIM) IP/MPLS.
Security	NERC-CIP (Critical Infrastructure Protection) compliant. OT Security that is utility best practice.	Generic Enterprise Cyber Security – ISO27001/2. Overall enterprise cyber security risk.	Integrated Cyber Security.
Interfaces	Electromechanical, coded displays/customised Graphic User Interfaces (GUIs), computer based Human Machine Interface (HMI).	Windows-based GUI, terminal and keyboard (desktop / laptop).	Converged connectivity.
Connectivity	Mostly hardwired control networks, serial / non-IP protocols, may use Internet Protocol (IP) as part of protocol stack. This includes telecommunication infrastructure.	Typically IP-based connectivity with significantly lower performance requirement except between data centres, voice and video applications.	Converged connectivity.
Operating Systems	Application dependent deterministic or non-deterministic multitasking, embedded.	Non-deterministic multitasking, e.g. Windows.	Mixed and / or converged / shared.
Environment	Typically deployed in harsh environments.	Typically deployed in office environments	Mixed and / or shared.
Type of Data	Real time / Near-real time data.	Non-real time, batch orientated data for Enterprise systems, real-time for IP-based voice, video, inter-data centre, mobile data terminals..	Various as required by end to end solutions.
Ownership	Technology Group and Operating Unit managers.	Group IT.	Group owned, jointly governed or as per business model.
Usage	24/7 availability required.	Mainly business window but can also be 24/7.	Various as required by end to end solutions.
Service Provisioning	Services usually cannot be outsourced due to the critical infrastructure needs.	Some Services are outsourced but all under control of Group IT.	Core not usually outsourced.
Consequence of Failure	Risk of electricity network downtime, potentially catastrophic, security risk, loss of life.	Less likelihood of impact on network operations. Transaction delays and unproductivity and impact on business operations. Can include loss of life.	Combination of both.
Business continuity	Keeping the lights burning. Core product mission critical systems and services including its facilities and support systems.	Business processes critical support systems including its facilities and support systems.	End to end optimised operations.
Typical present examples	EMS, SCADA, Substation Automation (SA), Distribution Automation (DA). Protection Schemes, Meters, Telecommunications infrastructure, etc.	Solutions and systems for SAP, Outlook, Maximo, SAP, SPF, OVS, CC&B, Smallworld, etc.	DMS, AMI , MDMS, MV90, Visualisation, etc.

Note: The on-going convergence trends between OT and IT are shifting the traditional boundaries between OT and IT, hence the need for on-going flexibility on the boundaries and managing the level of convergence.