Presented at the FIG Working Week 2023,
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Protecting Our World, Conquering New Frontiers

CYBER SECURITY, DATA QUALITY AND OPENNESS IN LAND ADMINISTRATION

ACCESS CONTROL MEASURES FOR UGANDA NATIONAL LAND INFORMATION SYSTEMS TOWARDS CLOUD.

PRIVACY AND SECURITY ISSUES

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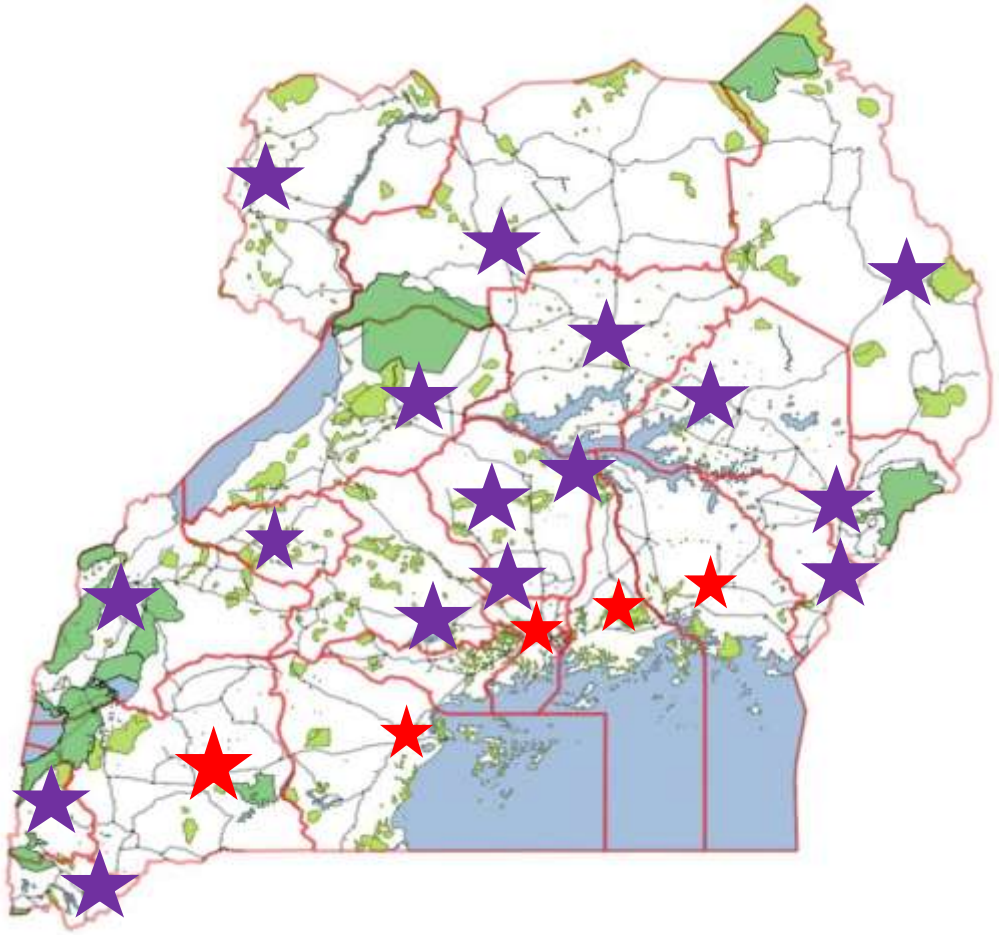
Introduction

- The Uganda government secured funding from World Bank to support the development and implementation of the land information system. This was carried out in (03) three phases: - With the first phase having the baseline study, Preliminary Design of the Land Information System and Strategy for securing of land records which was completed in 2007. This was followed by the detailed design, Installation and pilot implementation in 2010. Phase III, rolledout and decentralized the National Cadastre and the LIS across (22) twenty-two locations (zones) . With the migration from the manual records (paper-based) to digitalization of the cadastral data and land records, it is important that the CIA triad is put into consideration.

LIS Phase 1 (2010-2013)

- Kampala
- Wakiso
- Mukono
- Jinja
- Masaka
- Mbarara



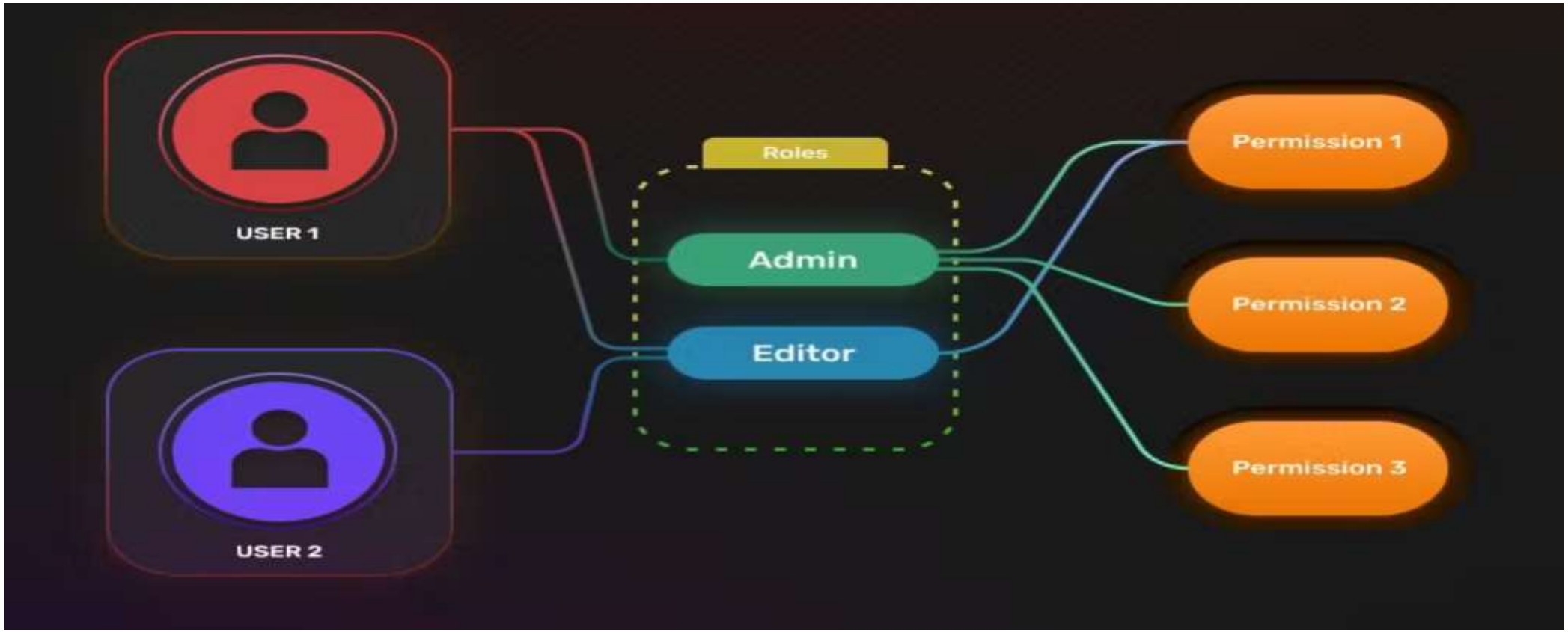
LIS Phase 2 (2015-2020)

- Lira
- Kabarole
- Kibaale
- Arua
- Gulu
- Masindi
- Mbale
- Mpigi
- Rukungiri
- Kabale
- Mityana
- Luwero
- Soroti
- Tororo
- Moroto
- Wakiso 2

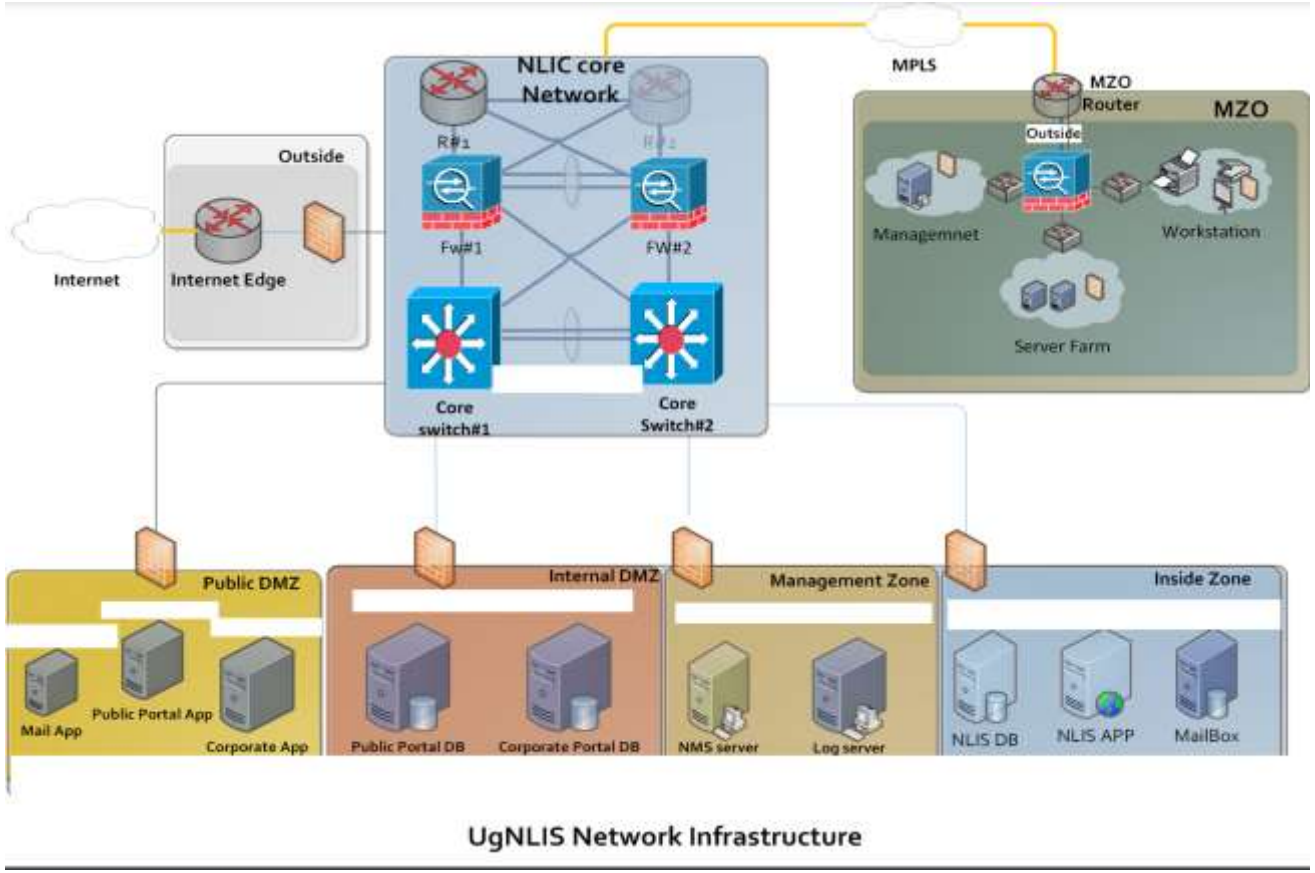
PRIVACY AND SECURITY ISSUES

Implementing access control measures for Uganda's National Land Information Systems (NLIS) towards the cloud involves various security practices to ensure the protection of sensitive land-related data. Here are some key measures that can be implemented:

Role-Based Access Control (RBAC):



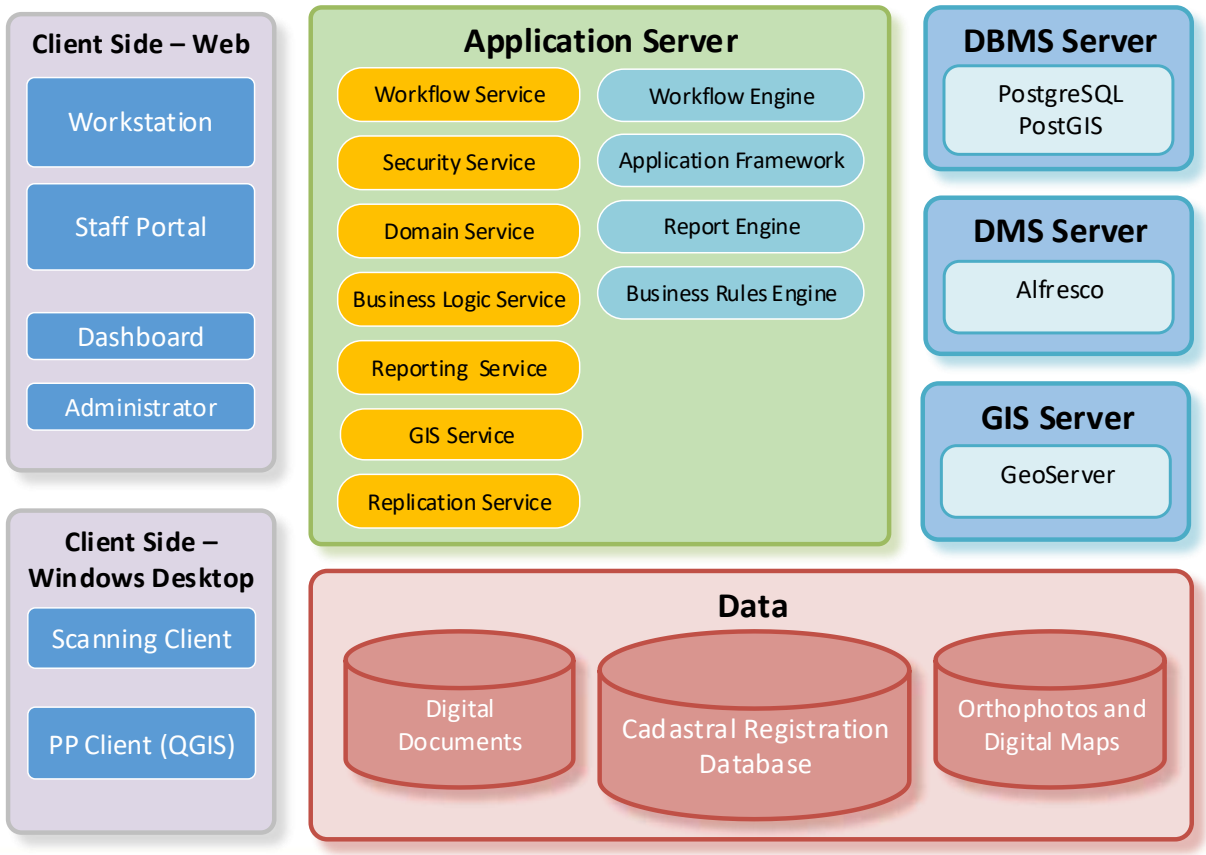
Secure Network Architecture:



UgNLIS Network Infrastructure

Uganda NLIS – Architecture and Functionalities

Architecture – MZO Components



Servers

- Application Srvr
- GIS Srvr
- DBMS Srvr
- DMS Srvr

Data

- Cad-Reg DB
- Digital Docs
- Map Imagery

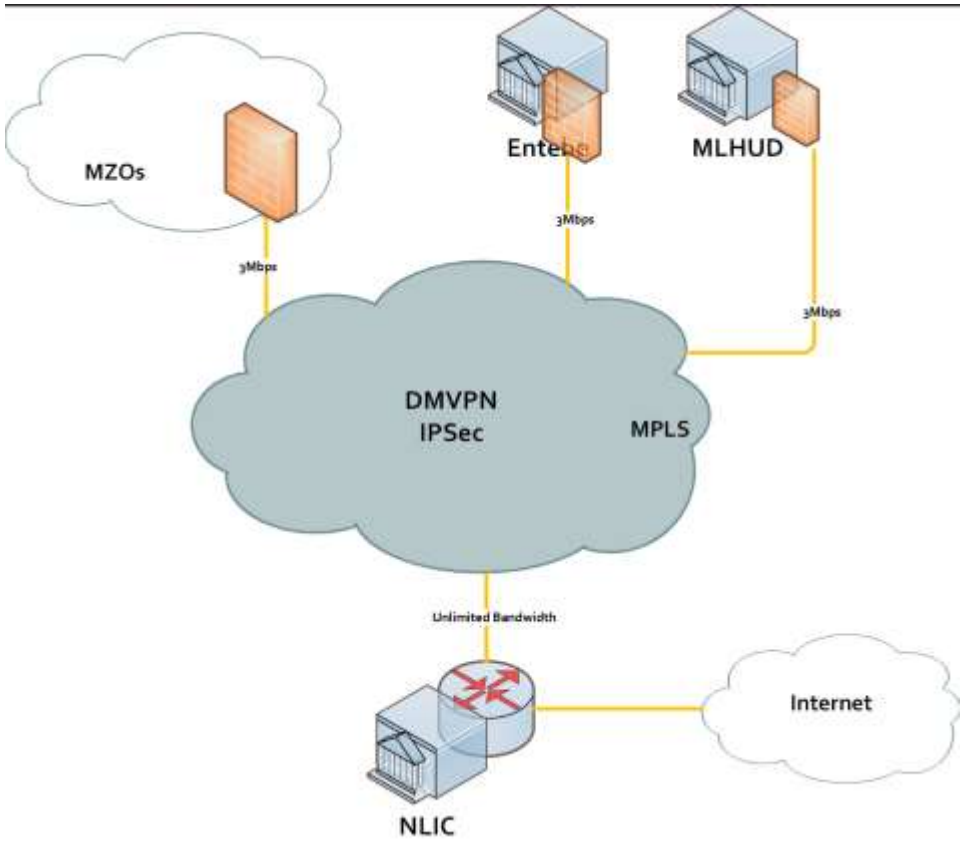
Authentication Mechanisms:

Authentication Log

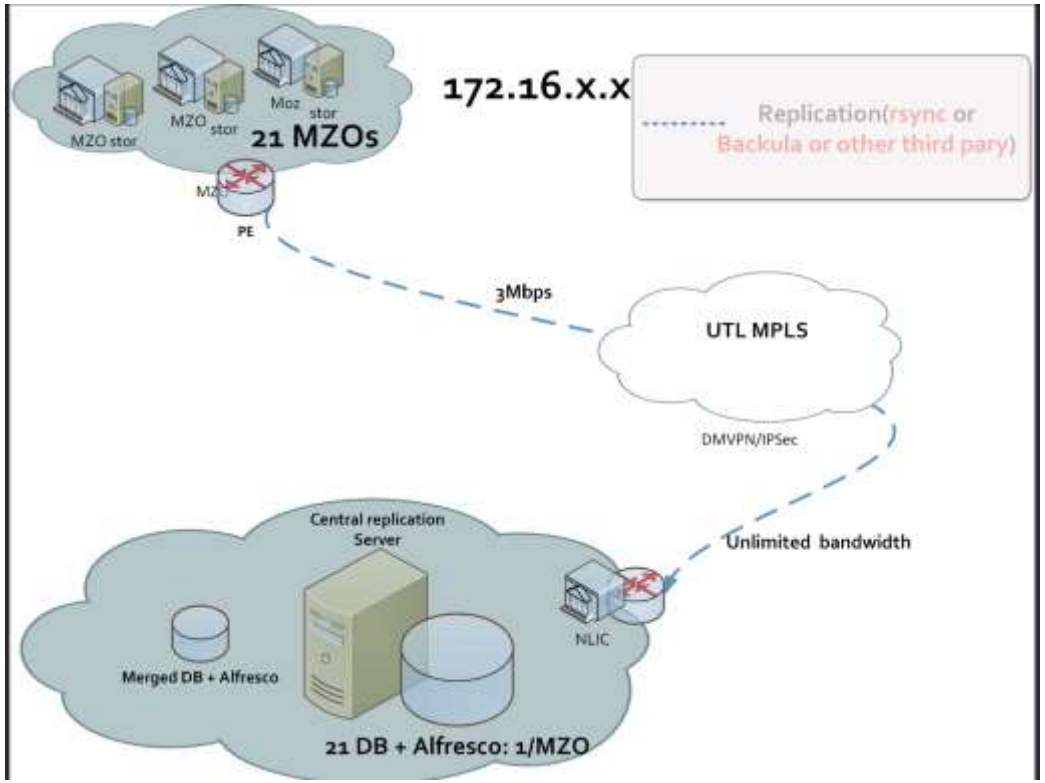
Category | User | Period | Non-Working Hours

USERNAME	NAME	EMAIL	EVENT TYPE	CATEGORY	DATE/TIME	APPLICATION
lvoonyu	Lenin lenin.victor	lvoonyu@nlis.go.ug	Success	Login	20/May/2023 16:54	Workstation
ernest.muwanguzi	Ernest Ernest Muwanguzi	ernest.muwanguzi...	Success	Logout by Expiration	20/May/2023 16:52	
ernest.muwanguzi	Ernest Ernest Muwanguzi	ernest.muwanguzi...	Success	Login	20/May/2023 16:19	
godfrey.toko	Godfrey Toko	godfrey.toko@nlis....	Success	Logout by Expiration	20/May/2023 16:17	
godfrey.toko	Godfrey Toko	godfrey.toko@nlis....	Success	Login	20/May/2023 15:36	Workstation
daniel.muwanguzi	Daniel Daniel Muwanguzi	daniel.muwanguzi...	Success	Logout by Expiration	20/May/2023 14:49	
margaret.adengi	Margaret Adengi	margaret.adengi@...	Success	Logout by Expiration	20/May/2023 14:47	
godfrey.toko	Godfrey Toko	godfrey.toko@nlis....	Success	Logout by Expiration	20/May/2023 14:27	
daniel.muwanguzi	Daniel Daniel Muwanguzi	daniel.muwanguzi...	Success	Login	20/May/2023 14:16	Staff Portal
godfrey.toko	Godfrey Toko	godfrey.toko@nlis....	Success	Login	20/May/2023 13:49	Workstation
margaret.adengi	Margaret Adengi	margaret.adengi@...	Success	Login	20/May/2023 13:43	
golooba.haruna	Haruna Golooba	haruna.golooba@...	Success	Logout by Expiration	19/May/2023 19:28	
golooba.haruna	Haruna Golooba	haruna.golooba@...	Success	Login	19/May/2023 19:22	
golooba.haruna	Haruna Golooba	haruna.golooba@...	Failure	Invalid Password	19/May/2023 19:18	
ernest.muwanguzi	Ernest Ernest Muwanguzi	ernest.muwanguzi...	Success	Login	19/May/2023 19:01	
golooba.haruna	Haruna Golooba	haruna.golooba@...	Success	Login	19/May/2023 18:55	
ivan.ssekitoleko	Ivan Ssekitoleko	ivan.ssekitoleko@...	Success	Logout by Expiration	19/May/2023 18:11	
godfrey.toko	Godfrey Toko	godfrey.toko@nlis....	Success	Logout by Expiration	19/May/2023 18:03	

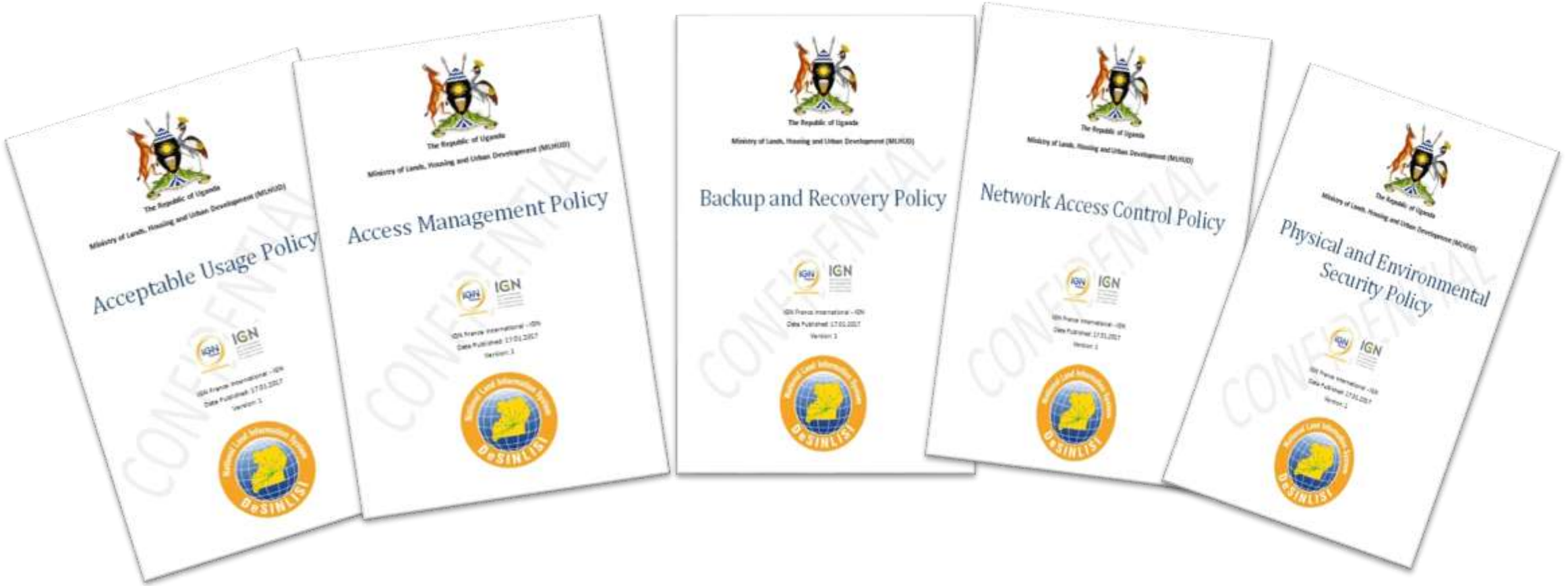
ENCRYPTION:


MZOs
Entebs
MLHUD
3Mbps
3Mbps
3Mbps
DMVPN
IPSec
MPLS
Unlimited Bandwidth
Internet
NLIC

Secure Data Storage:



REGULAR SECURITY AUDITS:



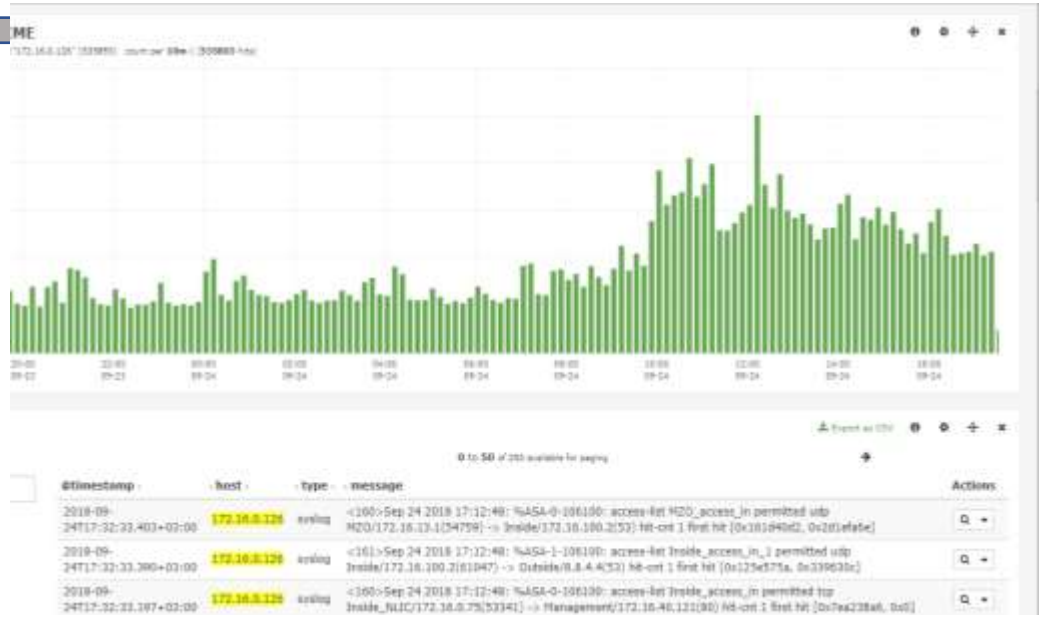
REGULAR SECURITY AUDITS:

Category User Period Non-Working Hours

USERNAME	PHONE	EMAIL	EVENT TYPE	CATEGORY	DATE/TIME	APPLICATION
esther			Failure	Non-Existent Account	24/Sep/2018 17:29	Workstation
gertrude	Kl...		Success	Login	24/Sep/2018 17:06	Workstation
gertrude	Kl...		Success	Logout by Expiration	24/Sep/2018 16:46	
briann	Br...		Success	Login	24/Sep/2018 16:45	Workstation
briann	Br...		Success	Logout by Expiration	24/Sep/2018 16:45	
gertrude	Kl...		Success	Login	24/Sep/2018 16:07	Workstation
briann	Br...		Success	Login	24/Sep/2018 15:52	Workstation
briann	Br...		Failure	Invalid Password	24/Sep/2018 15:50	Workstation
aisha	Al...		Success	Login	24/Sep/2018 15:37	Workstation
aisha	Al...		Failure	Invalid Password	24/Sep/2018 15:37	Workstation
aisha	Al...		Success	Logout by Expiration	[illegible]	
felix	F...		Success	Logout by Expiration	24/Sep/2018 15:30	
aisha	Al...		Success	Logout by Expiration	24/Sep/2018 15:25	
briann	Br...		Success	Login	24/Sep/2018 15:13	[illegible]
briann	Br...		Success	Logout by Expiration	24/Sep/2018 15:13	
felix	F...		Success	Login	24/Sep/2018 14:59	Workstation
aisha	Al...		Success	Login	24/Sep/2018 14:56	Scan Module

Dashboard

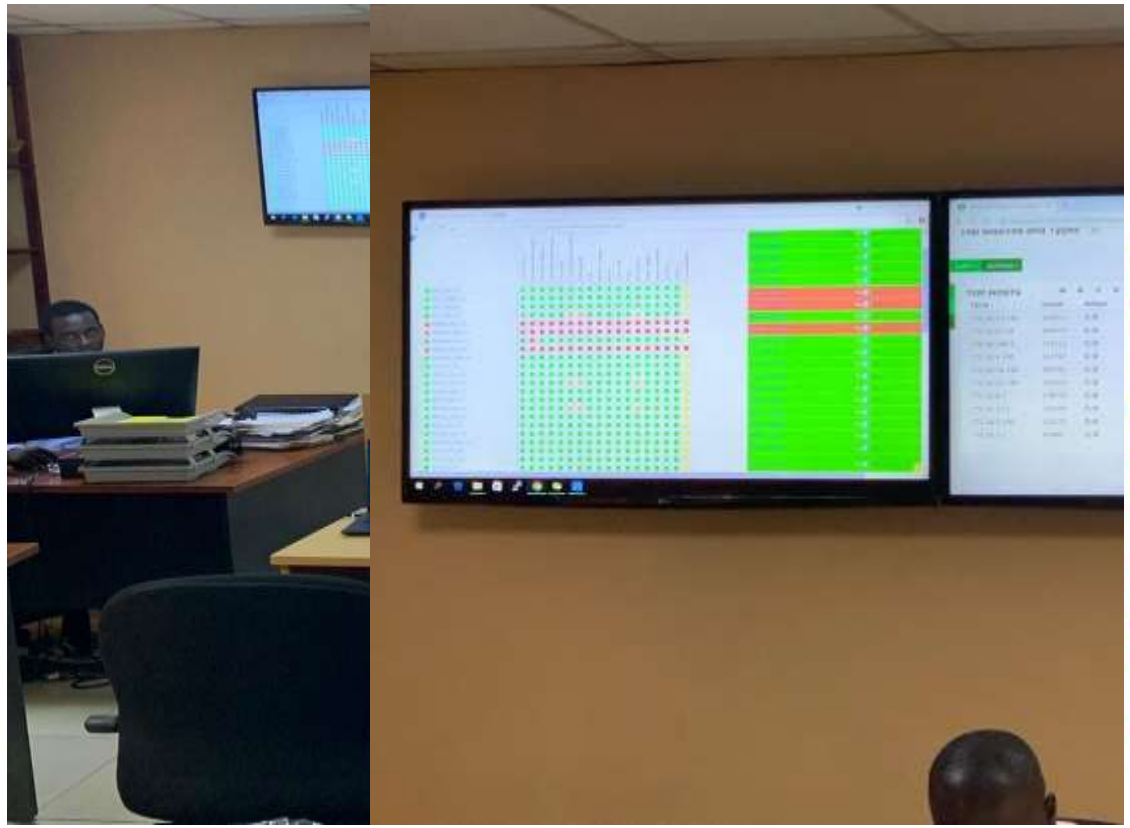
Access to the System

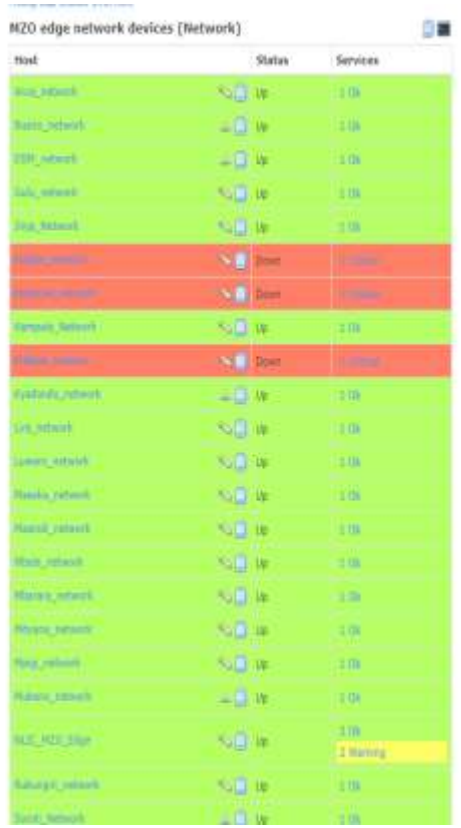


Physical Control (CCTV, Access Control):

SECURITY

INCIDENT RESPONSE PLAN:





INCIDENT RESPONSE PLAN:

- To increase NLIS availability
- To increase NLIS security
- To increase service support
- For real time problem support

→ **Central Level NOC**

- To improve MZO productivity
- To get statistics (registration)
- To produce reports

→ **MZO Level Daily Case Management**

PRIVACY AND SECURITY ISSUES: UgNLIS NOC (NLIC)

Functions

- Network operations
- Problem management
- Performance measurement and tuning
- Configuration control
- Security management
- Management reporting

REGULAR UPDATES AND PATCH MANAGEMENT:

PRIVACY AND SECURITY ISSUES: CONCLUSION

The use of cloud computing has been widely adopted by many organizations since it provides many benefits like high computation power, scalability of applications, access to information from different locations and lower cost operation and maintenance by the user. However, security and privacy aspects have to be clearly defined and implemented to prevent data loss and breaches. The UgNLIS typically runs on a RBAC mechanism that is centralized and to migrate LIS operations to cloud there is need to adopt a tailored access control mechanism to tape into the many benefits of the cloud. Nevertheless, cloud vendors have constantly innovated cloud services to tackle the privacy concerns relating to how data is accessed, managed and stored.

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