Question 3.4: As packet-switched networks are becoming increasingly adopted as the main technology for power utilities' telecommunications networks, describe some challenges in preventing the adoption of a fully packet switched network for utilities.

1. Background

This contribution will focus on the utilisation of Telecommunication networks on the African Electric Power Utility (EPU) with special focus on Software Defined Network (SDN) applications. Many utilities in Africa still utilise the older technologies that are about to reach end-of-life. As a result, there are initiative to migrate from the legacy technologies towards an agile and more scalable telecommunication solution. This has spiked interest in packet labelled influenced approach, namely Multi-Packet Label Switching (MPLS) and SDN.

SDN facilitates the role of software running networks by using planes such that there is a separation between data forwarding plane and control plane. This is all enabled by the concept of Network Function Virtualisation (NFV). This concept focuses on reducing white box by amalgamating hardware devices into one set of equipment with multiple functionalities. The discussion will mainly focus on the SDN as an example of a packet-based solution for African EPU. This will conclude by benefits vs potential challenges of implementing such solutions within African EPU context.

2. SDN Technical Benefits

Amongst others, the following benefits were identified as the drivers for the SD-WAN solution:

- SDN is defined as the set of techniques used to enable the delivery and operation of network services in a deterministic, dynamic, and scalable fashion. This has enabled Organisation to have an agile and fully programmable network to run the Business and Industrial Network applications.
- The control plane sends defined actioned to the data or forwarding plane, then the forwarding plane performs the shared actions.
- This helps reduce deployment time for the additional satellite or sites, as the controller pushed configs and commands on the data planes. Instead of preparing configurations and commands for each satellite, these are then forwarded and managed centrally, through the control plane.
- This has a significant role in improving productivity and business continuity. If one of the data plane devices is replaced, the commands and configurations are then forwarded to the new member.
- Reduction in downtime ensures improved visibility of the satellites and the asset within the Renewable Power Plant (Satellite).
- The preparation of transport technology transmission links is also reduced, as a result there are potential savings for the business.
- Savings are also enabled by the reduction of white boxes, as the Organisation now requires, less hardware to bring up the satellite(s).
- The cost of Internet vs MPLS transmission links also plays a significant role in telecommunication cost reduction.

- However, the contrary can be said, pertaining to the Utilities that are currently owning the Telecommunication infrastructure are not heavily impacted by cost of internet.
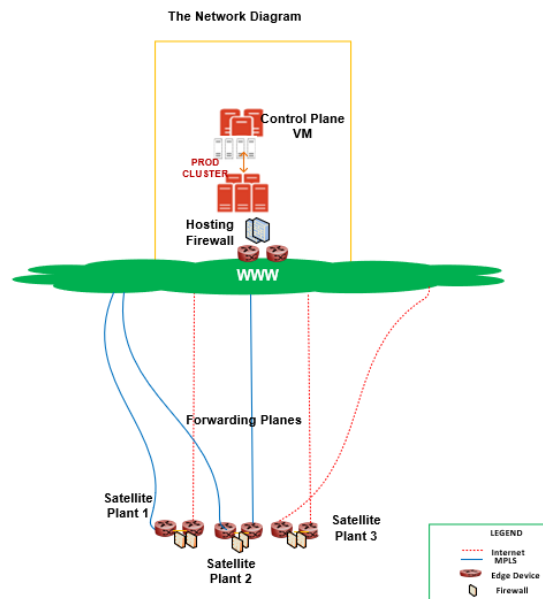

Figure 1: SD-WAN Network Architecture

3. African EPU SDN Adoption Challenges

The Majority of Electric Power Utilities (EPU) in Africa are still yet to migrate to packet enabled network engineering solutions. The drivers are mentioned below:

- Migration from legacy to packet enabled solutions might require a core network overhaul. This is an expensive and yet risky exercise.
- Most of the legacy solutions are reaching the end-of-life, resulting in support being scarce and expensive.
- Lack of budget from the business to migrate from legacy to packet enabled solutions.
- One of the risks cited by the utilities pertains to the cyber-security elements. There is a lack of trust on utilising Internet Protocol (IP) based solutions especially for tele-protection.
- Moreover, the Internet Service Providers (ISP) only commit to network availability compared to throughput and Quality of Service (QoS) Service Level Agreement.
- Utilities that are owning Telecommunication networks are not heavily impacted by ISP internet cost vs MPLS. Also, they are in full control of latency related challenges.

4. Conclusion

The SDN applications brings sizable advantages to the African EPU in terms of enabling bi-directional flow of information between the Headquarters (HQ) and Satellites /Campuses. With that said, there are also challenges pertaining to the points mentioned on Section 3. Many EPU utilities are hesitant to migrate from serial to packet-based Telecommunication solutions, with some citing cyber-security risks and lack of risk appetite to follow futuristic trends.

The futuristic trends are driven by obsolete support of legacy Telecommunication services whilst the cost vs benefits also play a significant role. For the EPU that does not own their Telecommunication networks, they are seeing a benefits in terms of MPLS vs internet costs. However, those that own their own infrastructure not so much. They face a challenge of

reliability network vs aging infrastructure. Further studies should be performed by Cigre D2 with special focus on serial to packets-based solutions for African Utilities.