Exploring SLT's Datacenter Infrastructure – A Detailed Report

Image 01: Overview of the datacenter

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Sri Lanka Telecom PLC is the largest telecommunications provider in Sri Lanka and serves as the country's primary digital and communications backbone. It was established in 1991 and evolved into the leading force in telecommunications offering almost every aspect of digital infrastructure. SLT is now equipped with cutting edge technologies such as IoT, 4G LTE, fiber optics, AI and upcoming 5G technology as well.

With the advancement of the technology, data has become the world's most valuable asset, essential to business operations and driving progress toward a fully digital landscape capable of rapidly meeting evolving customer needs. Identifying the needs of securing customer data and offering enterprises a way to maintain there own on-premises data stores such as dedicated servers, SLT has established the Sri Lanka's largest datacenter in Pitipana, Colombo.

The Pitipana datacenter is a purpose-built, Tier III Uptime Institute-certified facility, designed to meet high standards of reliability and performance. While classified as Tier III, it incorporates several Tier IV-level features to further enhance resilience and ensure minimal downtime. It is situated 24 km of radial distance away from the SLT headquarters and 55 km away from the Katunayake international airport which can be reached within 45min via the Express way.

The primary service of the SLT datacenter at Pitipana is Co-Location and they offer 4 main services to their customers. They are,

1. Power
2. Cooling
3. Networking
4. Security

Although Pitipana datacenter serves as the center for the enterprise infrastructure, there are several other datacenters situated at different locations in the country. One is located at the 3rd floor and the 5th floor of the headquarter building. Welikada datacenter is another one that the SLT owns. Almost all of these datacenters serve the co-location as their primary service.

Image 02 : Tier III certifications for design and facility

The datacenter premises spreads over 63,000 sq. ft and the land covers nearly 2 acres. It is built in a technical zone where no flights land and far away from the coastal area. The location is selected such that it avoids the frequently flooding area referring to the flood map of Colombo area. The area is infrequently affected by natural disasters and therefor ensures data resilience.

The SLT datacenter employs top-tier industry products and utilities to ensure maximum performance and minimal downtime. Key components include ABB transformers, APC UPS systems, FIAMM battery banks, CATERPILLAR generators, Trane chillers, and APC racks and containment systems. On the software side, SLT uses industry-leading solutions to optimize datacenter operations, including Palo Alto as the perimeter firewall, CISCO for networking, Schneider Electric for electrical components, and HP switches for internal networks. Additionally, an emergency lighting system is installed in the computer room to ensure continuous visibility during power interruptions. For protection against lightning, SLT has implemented C1-grade lightning protection and multiple lightning conductors strategically positioned around the premises using the rolling sphere method.

Network Architecture

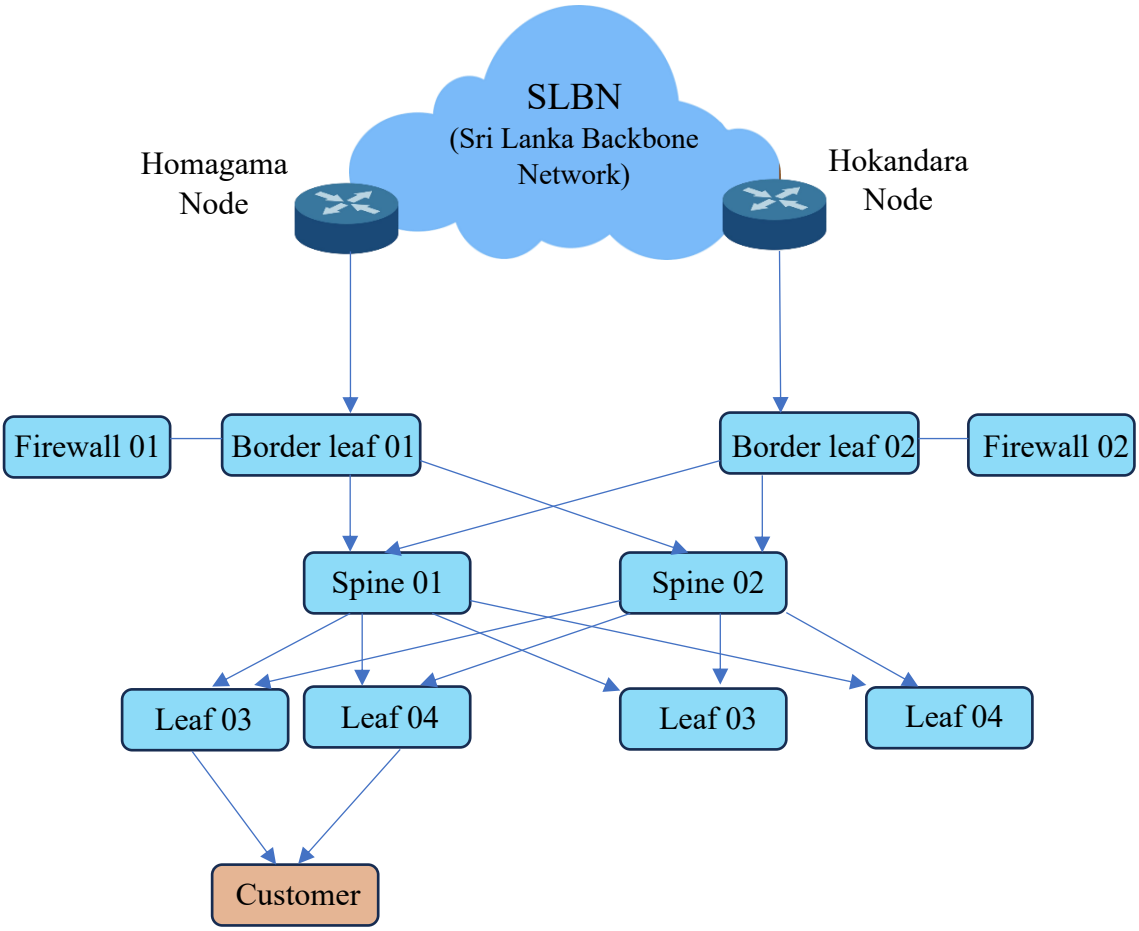

Image 03 : Network Architecture of the datacenter

Power System

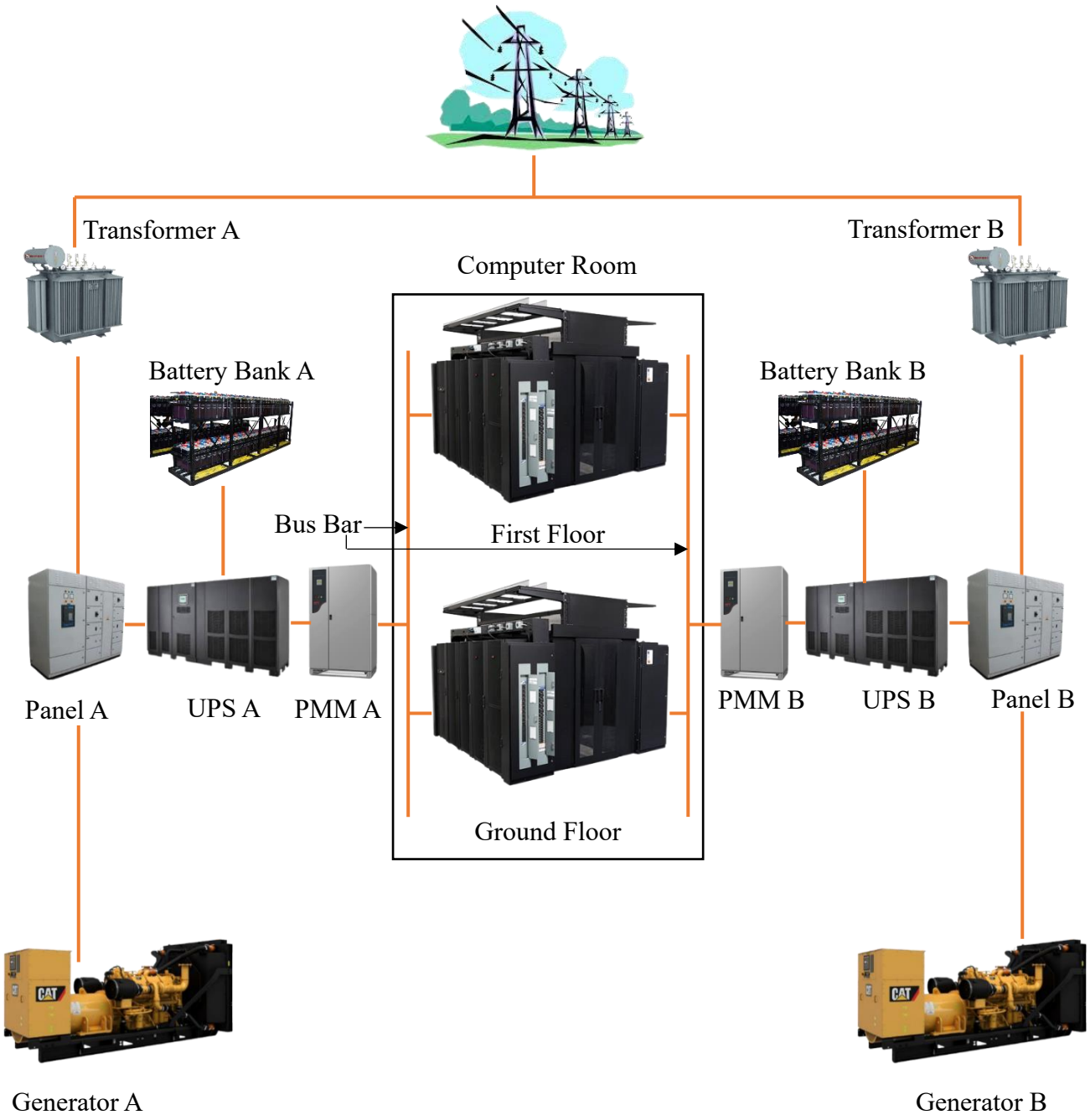

Image 04: Power distribution flow of the data center.

SLT Pitipana Data center Features

Electrical Subsystems

- N+1 Redundancy (Tier III facility)
- 2N Ups power (Tier-IV facility)
- 10 minutes UPS backup for each UPS feed at full load
- 48 hours fuel storage for generators at full capacity.
- Individual rack power metering.
- Emergency lighting system in the computer room.
- C1 Lightning protection system.

Mechanical Subsystems

- N+1 Redundancy (Tier III facility)
- Water cooled chillers
- Chilled water buffer tank storage – 10 minutes (Minimum)
- Fire detection and suppression system.
    - NOVEC1230 Gaseous fire suppression system.

The above diagram illustrates the operation of the datacenter's power system. Power from the national grid is delivered through two transformers connected to separate power lines, ensuring redundancy. Each transformer steps down the high-tension 33kV supply to 400V, which is then routed to the main power panel in the panel room. This 400V electricity is delivered to the UPS system, which is connected to an external battery bank that passes through a breaker before reaching the UPS system. The power panels are programmed with a PLC (Programmable Logic Controller) to automate the switching between CEB power and generator power. Another device, the Power Management Module (PMM), monitors and manages power distribution across the datacenter. To further enhance energy efficiency and maintain power quality, the SLT datacenter employs a capacitor bank system that improves the power factor by compensating for reactive power, optimizing power distribution and reducing the load on transformers. This setup ensures that, unlike standard domestic electricity, the power in the datacenter is of high quality, with minimal fluctuations and smooth transitions.

In the datacenter, redundancy is implemented across all critical systems, from power and networking to mechanical infrastructure, ensuring continuous operation. Each server rack is supplied by two distinct power sources, referred to as sources A and B. The national grid delivers power via two separate lines, one feeding Transformer A and the other Transformer B. This redundancy extends to all components, including two panels, two UPS systems, battery banks, and Power Management Modules (PMMs). Within the computer room—the datacenter itself—all power lines are routed through metal bus bars, which efficiently handle high currents, such as 5000A. Bus bars are also chosen for their compactness, making them an ideal solution for environments where large numbers of cables would be challenging to manage. Both AC and DC bus bars are available to meet the varied power requirements of different customers. Additionally, the datacenter incorporates patch panels to connect different sets of wires, facilitating efficient organization and maintenance of network connections.

Controlling temperature and humidity is essential in datacenter environments to protect equipment and maintain operational stability. To achieve this, the SLT datacenter employs several advanced cooling systems, including Precision Air Handling Units (PAHUs). PAHUs regulate temperature and air quality, providing precise control over environmental conditions. Unlike standard HVAC systems, PAHUs are specifically engineered to handle the high heat loads typical of datacenters, offering granular control over both temperature and humidity levels. These PAHUs and PMMs are located in technical room which is outside the computer room.

The data center also utilizes Ceiling Air Handling Units (CAHUs) strategically placed above the ceiling to enhance air distribution and control temperature and humidity levels throughout the facility. These units work in conjunction with other cooling systems, such as Precision Air Handling Units (PAHUs) and the chilled water-cooling system, to ensure a stable and efficient cooling environment.

The Pitipana datacenter employs an efficient chilled water-cooling system to maintain optimal temperature levels within the facility. This system includes a water buffer tank with a capacity of 22,000 liters, ensuring a consistent and continuous supply of chilled water to the cooling units, even during sudden power failures. The chilled water is circulated through cooling lines installed beneath the raised floor, where it absorbs heat from the datacenter environment. The chiller room also utilizes VRF (Variable Refrigerant Flow) technology, which enables precise temperature control by adjusting the refrigerant flow based on the cooling demand. This level of control helps maintain a stable, energy-efficient cooling environment critical for the datacenter.

Cool air flows from the floor within each pod, passing through the servers and exiting the pod. A pod is a single unit within the computer room that contains several server racks, with the interior referred to as the cold tile and the exterior as the hot tile. Power lines also run under the raised floor. Additionally, the computer room side of the water-cooling system is equipped with water pumps connected to UPS systems, ensuring continuous water flow during power outages. However, the starter motors of the chilled water pumps are not connected to the UPS due to their high initial load when starting. The chilled water pressure is maintained at approximately 2.5 bars, and the chillers are monitored via a Centralized Plant Management (CPM) panel to ensure optimal operation.

To ensure continuous generator operation during power outages, the datacenter is equipped with two underground diesel tanks with a combined capacity of approximately 30,000 liters. Together, these tanks provide enough diesel to run the generators at full load for up to 48 hours. Diesel is pumped from these main tanks to makeup tanks, each holding around 1,500 liters, which supply fuel directly to the generators.

The Pitipana datacenter is equipped with an advanced fire detection and suppression system to safeguard critical equipment. Smoke detection and heat sensors are strategically placed throughout the computer room, enabling rapid identification of potential fire hazards. For early detection, the facility employs VESDA (Very Early Smoke Detection Apparatus) technology, which senses smoke particles long before they become visible, allowing immediate preventive action. If a fire is detected, gas nozzles installed within the rooms automatically activate, releasing suppression gas to contain the fire. Additionally, fire alarms positioned outside the rooms promptly notify workers of the incident, ensuring swift evacuation and response.

To suppress fires effectively, the datacenter uses the NOVEC 1230 gaseous suppression system, a non-toxic, environmentally friendly solution that rapidly extinguishes fires without damaging sensitive electronic equipment. Each NOVEC 1230 fire extinguisher unit is valued at approximately 25 lakhs, reflecting the facility's commitment to fire safety. In the panel rooms alone, there are around 3-4 units, while the power control area houses approximately 10-12 extinguishers. Additional extinguishers are also placed within the computer room to provide comprehensive fire protection across the facility.

The Pitipana datacenter has a rigorous maintenance schedule, with services conducted every one and a half years for all units and systems as needed. The Network Operation Center (NOC) plays a crucial role in monitoring the facility's operations. They utilize a Building Management System (BMS) to oversee various systems, including temperature control, power management, and environmental conditions.

For specific monitoring tasks, such as CCTV systems and battery bank status, the datacenter relies on an internal network typically referred to as the HP Network. This network, consisting of HP switches, is dedicated solely to internal purposes and is segmented into VLANs (Virtual Local Area Networks) to streamline management and enhance operational efficiency. For battery bank monitoring, a software tool called "DUDE" is employed, allowing for real-time tracking and analysis.

Physical security within the datacenter is paramount. All access points are secured with robust locking mechanisms that require authorized personnel to use an identity tag to unlock the doors. This access control system ensures that only authorized individuals can enter sensitive areas. Furthermore, all doors are constructed from metal, providing resistance against fire and contributing to the overall safety of the facility.

The SLT Pitipana datacenter showcases advanced design and technology in managing data and infrastructure. Innovative technologies like Variable Refrigerant Flow (VRF) and Precision Air Handling Units (PAHUs) help maintain the right environment for sensitive equipment. This report illustrates the critical aspects of the SLT datacenter's infrastructure and operations, reflecting the dedication to providing reliable, secure, and efficient data services.

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