Implementation of Building Construction and Environment Control for Data Centre Based on ANSI/TIA-942 in Networking Content Company

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Abstract. The data centre room is different with other networking or IT type of room, which its space are necessarily required certain stringent requirements to achieve borderline of safety and stability in the prevention of interference or disturbance either physically or digitally. Therefore, it should also take note of the ease and access of the user to the data by considering the aspect of necessities and maintenance. Data center also transport energy upstream and greenhouse gas emissions due to processes, the resources and capital equipment used to extract and build, which should be considered carefully to avoid worst case scenario. This study explore the implementation issues in specific networking content company in Indonesia to manage building construction and environment control based on criteria derived from ANSI/TIA-942.

1. Introduction

The power consumption of the data centre has attracted worldwide attention due to the rapid growth of the IT industry. Data centres in the United States consumed 61 billion kilowatt-hours (kWh), or 1.5 percent of total US electricity consumption. In 2006, and this number is likely to double by 2011 [1]. These projections suggest that, unless energy efficiency is improved beyond current trends, the cost of federal government electricity for servers and data centres could reach $ 740 million per year for 2011. Furthermore, at around 60% of the energy consumed in the data centre Due to the lack of environmental information and excessive cooling systems [2]. In Indonesia, the estimated usage at 1.5% of total electricity generation in 2014 with around 2.0% and 3.0% by 2017 for the data centres. On the other hand, the demand between 2016 and 2017, is expected to increase from 236-405 megawatts in all 10 kW data centres that put high pressure and hard limits to the supply capacity throughout the country [3]. Meanwhile, the Indonesian government regulations No. 82/2012 put emphasis on the utilization of data centre in the data management and control that should be started massively by 2017, of course, this will increase the usage of energy and electricity as well.

A data centre can be classified based on energy utilization, which are small (10kW-150 kW), medium (150 kW-750 kW), enterprise (750 kW-2,500 kW) and mega (more than 2,500 kW) or based on availability, which are Tier I - Basic (99.671% minimum uptime and 1,729 minutes maximum downtime), Tier II – Redundant (99.741% min and 1,361 ms max), Tier III – Concurrent (99.982% min and 95 ms max) and Tier IV – Fault Tolerant (99.995% min and 26 ms max) [3, 4, 5, 8]. On the other hand, the room designed should be in such a way as secure and safety as possible to place the computer servers and network devices connected to the Internet network. The purpose of the data centre is to provide centralized facility to support accessibility, quickly, stability and safety process in
utilizing data source while at same time secured from interference. Thus, some criteria should be met restrictly to avoid disaster such as a location that is free and safe from floods, earthquakes and landslides or physical disturbances such as anarchic demos and any other disturbances. This is very important as a standard that can minimize the risk or impact that may disrupt the investment or operations cost of the company, even it can jeopardize the reputations, which is extremely difficult to build but can be broken down easily when bad things happen to customers. In addition, data centres are also required high reliability in accessing data by users such as fibre optic-based internet network speed, expertise in managing network efficiency such as load balancing or bandwidth management and offer server colocation services. Furthermore, other criteria such as the scalability to provide flexibility in serving customers should be considered as well such as the ease of server usage and customization. This needs to be supported by a design structure and construction that can provide efficiency and selection of device usage within the activity process that supports them effectively. Thus, this study explores the common implementation issues in the management of building construction and environment control to the data centre, particularly to networking content company in Indonesia.

2. Literature Review

Researchers estimate that there are around 10 million inactive servers worldwide involving stand-alone and host servers in virtual environments called asomatose servers, which continue to use energy but have not performed any useful functions during 6 months or more, indicates at least $30 billion capital sitting idle [3]. Data centres consume high levels of energy to operate their IT equipment and extract the heat they produce. Because the industry has relied heavily on energy, data centre metrics have historically used operational efficiency as an indicator of sustainability. More recently, the industry has begun to realize that its focus must go beyond energy, with measures for problems such as carbon, water and information efficiency. However, the rules of a single release often take into account the operational phase, while eliminating them from other problems, during the other stages of the life of the installation [4, 5]. Energy consumption in data centres has attracted worldwide attention due to the rapid growth of the IT industry, which is up to 60% of the energy consumed in the data centre has used for cooling system due to lack of environmental information and excessive compensation [6]. The power management of the data center includes three core components of the technological infrastructure, which are the energy distribution of data operations, cooling systems used to control environmental conditions in computer buildings and power supply system sources connected to the data center [7].

The actual costs of downtime, interruptions and failures in the data centers, which are reported at around $90,000 per hour in the media industry to $6.48 million in financial brokerage or banking service are often underestimated. There are also reputational costs that translate into distrust of investors and consumers, which can prevent further investments or sales or the huge impact loss that human lives may be at risk as well [3]. According to ANSI/TIA-942 [8], data centers should have exclusive room to support the networking infrastructure, which can be categorized as entrance room to connect access provider with the data center cabling, main distribution area (MDA) to provide central point, intermediate distribution area (IDA) to accommodate lack of space, horizontal distribution area (HAD) to support cabling to EDA, LAN, SAN, console and KVM switch, zone distribution area (ZDA) for coaxial and twisted-pair connection, lastly equipment distribution area (EDA) to allocate space for computer and communication device. Furthermore, in the process of building construction, there are several steps to be considered namely determination of floor grid, fire suppression tanks, aisles and raised floor installation. Meanwhile, in the process of environment control discusses the monitoring on Network Operation Center (NOC), develop Standard Operating Procedure (SOP), create heating, ventilation and air conditioning (HVAC), make fire suppression system and operational parameter, batteries and power supply.
With the growing energy consumption, there are many effort to increase the efficiency in the operational process of data center by number of metrics introduced respectively such as Power Usage Effectiveness (PUE), Energy Reuse Factor (ERF), Green Energy Coefficient (GEC), Site Infrastructure Energy Efficiency Ratio (SI-EER), Data Center Infrastructure Efficiency (DCIE), Data Center Energy Productivity (DCEP), Server Compute Efficiency (ScE), Data Center Computer Efficiency (DCCe), Data Center Performance per Energy (DPPE), Carbon Usage Effectiveness (CUE), Water Usage Effectiveness (WUE) and EDE (Electronics Disposal Efficiency) [4]. The cost analysis conducted by the academicians reveal the importance of improving the work done in the investment of data center, which the resources often operate at low latitudes due to abstraction and fragmentation. Therefore, the speed of the network and the appropriate incentives for resource consumption must be considered, while at the same time, geographic diversity can reduces latency for users and increases the reliability of an interruption that leads to a complete site. In addition, the data center services must be designed with the joint optimization of network resources or through mechanism for geodistribution slate [9].

3. Research Method

This study use ethnography to explore the implementation issue by delegating two students from Telkom University as internship for at least 14 weeks. This method is a qualitative method that use kind of perspective of beliefs, social interactions, behaviour or small societies, involving participation and observation over period of time and the interpretation of the characteristics or attribute as the data collected [10]. In this process, those student create planning scheme, which consist of 7 (seven) phases namely the identification, analysis, visitation, checking, monitoring, maintenance and execution. Some discussions in the internship phases related to improvement process and procedure in Disaster Recovery Center (DRC) maintenance, connection of cable and cabinets, power supply and transformer and operational standard. In each phase, students take a log note then draw the diagram of business process lead to the conclusion of efficiency and effectiveness of certain activities.

4. Analysis and Discussion

The primary concern of the industry is related to the implication financially to the investment of new technology infrastructure which is extremely high consumption but the awareness has been there especially the environmental impact and the availability of fuel supply [4]. The activity that involved building construction such as data collection on durability, data center structure, floor capability, computer room air conditioning (CRAC) and security in connection corridor. This company building has been identified to be earthquake resistant of 6.5 Richter Scale with TIER-3 based on ANSI/TIAA-942 [8]. There are several POP rooms in this building as the point to connect the users with company networks, which will be determined based on the closest distance in the form of shelter, ODC, GITET, GI, Kadist, APJ, UPJ or any other company offices. It will create the communication between user and network backbone that combined IP devices with SDH (Synchronous Digital Hierarchy)/ SONET (Synchronous Optical Network) kind of devices. For the security of the building, allocated trained personal will secure every point of the building within multiple levels behind door entry available at 24 hours in a week through various physical identification and surveillance mechanism such as CCTV, access key, PIN and proximity card (RFID).

In the physical security, several issues have been raised such as insufficient monitoring control mechanism towards janitor, office boy or even the security personnel, which open possibility the data stolen or destruction through collaboration conspirators used shifting schedule information or location. Other possibilities of infiltration or exfiltration of physical property in the building due to lack of numbering and indexing mechanism of the asset that create opportunities to remove or bring the assets in or out of facility. Besides that, improper disposal or destruction of organization information also should be considered while there is no proper device to detect and identify threats enter inside the facility. Thus, the company should implement role or party based access control at various point and level from parking lots, toilets, canteen and any other empty spot within the area of building to make
intrusion become difficult to execute. On the other hand, the establishment of risk analysis should be conducted on annual basis to keep track of security event in analysing major and minor vulnerabilities that take place in certain period. Furthermore, the update process to reject access for the retired or fired employee should be done immediately by restriction or limit the access once the status have been changed based on certain instruction by the responsible managers.

![Figure 1. Building Structure 1 and 2](image1)

| Processor (GHz) | Memory (GB) | Storage (TB) |
|----------------|-------------|--------------|
| POD 2          | 36.10%      | 23.10%       | 43.39%       |
| (C: 110.75/U:39.97) | (C: 1500/U:345.82) | (C: 55.22/U:23.96) |
| POD 3          | 4.27%       | 27.20%       | 43.39%       |
| (C: 726.04/U:31.03) | (C: 3750/U:1020) | (C: 55.22/U:23.96) |
| POD CLS        | 7.17%       | 8.06%        | 26.30%       |
| (C: 377.82/U:27.08) | (C: 5620/U:453.33) | (C: 23.87/U:6.28) |

![Figure 2. Capacity (c) and Used (u) in DRC and POD](image2)
The implementation of HVAC have been supported with generator system that can protect disaster with the normal setting, which are dry bulb temperature at 20°C (68°F) to 25°C (77°F), relative humidity level at 40%-55%, maximum dew point 21°C (69.8°F), maximum change rate 5°C (9°F) per hour and humidification or dehumidification equipment is needed depending on local environmental condition. The measurement has been done in the distance of 1.5m (5 feet) above the floor level every 3 to 6 meters along the midline of the cold alleys and in any location on the operating equipment air intake. On the other hand, Disaster Recovery Center (DRC) is the facility to take over primary division/unit when there is a disruption to the important division/unit within the company. The difference between DRC and data center is that the main role as a data repository will be replaced if there is a case of disruption in a certain period or preventive action during maintenance. Meanwhile, point of delivery (POD) is the facility in which consist of the collaboration of network components, storage devices and relevant applications that has function to serve customers in the management process such as scalability and customization. On the other hand, data centers need several UPS (Uninterruptible Power Supply) to provide additional electric to certain parts of computer such as monitor, CPU, etc. for the continuity service. In this case, the UPS standard uses redundancy N+1 where the main element and backup have been work together to prevent the impact from the failure in some element, which 2 (two) unit transformer have been installed with each capacity of 3100 KVA with 30% utilization and 2 units power supply with capacity of 800 KVA. There are several concerns should be empathized in the environmental control such as temperature control range, which ASHRAE decision to enlarged its recommended range from to 68° to 77°F to 65° to 80°F or at around 18.3°C to 26.7°C [11]. In addition, ASHRAE also recommends to have humidity control of 60% for a dew point level range of 5.5°C to 15°C. The installation of physical or sensory device related to the environment and facilities for temperature, humidity, energy, floods, smoke, airflow and entry to the room are the most economical ways to reduce unnecessary cost for the equipment or stop the unplanned downtime. Thus, the implementation of an environmental monitoring system should have the option to alert managers wherever they are through comprehensive accumulation of current condition in the data centers [12].

The company have provided certain spot with automatic fire suppression system and manual device but there is no periodic check and monitoring towards the quality of the automatic or manual system or even the mechanism. The system have been idle for several years, so the employees may forget the step-by-step that should be conducted and to whom they require to coordinate. On the other hand, proper control for the rack entry should identify the minimum and maximum weight that can be accommodated to monitor the endurance, which may degraded due to several reasons such as the material used, pressure or temperature effect. The company can add more features in the application to allow routine check and audit towards quality of critical equipment by developing the indicator such as implementation of three signature colors (green for low risk, yellow for medium and red for high). The integration function between portal website and manual monitoring can optimize the reminder, warning and other notification for escalation or migration process became quick and easy. Excessively dry air, as well as equipment or unqualified personnel, can accumulate harmful levels of stationary charge. The fixed equipment of electricity monitoring at intervals around the data center can report significant potential charges [13]. In addition, Kleyman also added that containment has become an important part of refrigeration management, so officials should distribute environmental sensors inside cold and hot passages while there should be no liquid water inside so sensors at low points within racks and aisles can report on leaks and condensation problems.

5. Conclusion

In general, the networking content company has been adopted the ANSI/TIA standard to the fully optimal level, but the improvement should be done by understanding the context used and the existing environment, which the building resided. Simply adopting the standard is not sufficient due to differences in the organization culture, pattern of the employee, work commitment and budget constraint that absolutely influence the outcome level and consequence faces by the company. In
conclusion, physical security should be conducted in properly identified limitation and responsibility of each employee while safety controls, such as fire suppression devices and water detection sensors, must be adequately configured and tested to protect the company's investments in data centers with consider several criteria to guide the implementation and proper routine to check and re-check the quality of the equipment and the smooth mechanism.

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