**NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES**

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**REPORT**

PERFORMANCE METRICS: A COMPARATIVE ANALYSISOF FAST UNIVERSITY AND AHMAD JAMAL MILL DATA CENTERS

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**SECTION:** A

**LOCATION OF SITES**

* Fast University CFD Campus
* Ahmad Jamal Mill Khurianwala, Faisalabad.

**TARGET AUDIENCE**

* University Students
* Teachers
* Tech Enthusiasts (Beginners)

**INITIATION BRIEF**

In this report, we delve into a comprehensive comparison of Fast University and Ahmad Jamal Mill Data Centers. Our visit provided valuable insights into the clear concepts, operational efficiency, and overall benefits offered by both centers. The analysis spans key components such as ISPs, routers, power backup systems, storage solutions, servers, switches, NVRs, firewalls, telephone systems, and device health mechanisms. By evaluating the standards implemented, we aim to provide a brief yet insightful comparison. Recognizing the inherent differences between a university and a mill data center, we highlight strengths, vulnerabilities, and areas for improvement in handling diverse technological aspects. This examination sheds light on how each center navigates the unique challenges posed by its distinct operational environment.

* **INTERNET SERVICE PROVIDERS (ISPs): ENSURING CONNECTIVITY RESILIENCE**

**FAST UNIVERSITY:**

**ISP DIVERSITY FOR REDUNDANCY:**

* **PTCL (PAKISTAN TELECOMMUNICATION COMPANY LIMITED):**

**LOCATION:**

* Faisalabad
* Chiniot

**SPEED:** 1000 Mbps (Expandable to 2000 Mbps, uncapped)

**REDUNDANCY:** Dual presence for enhanced fault tolerance.

* **HEC (HIGHER EDUCATION COMISSION) ISP:**

**OPTICAL FIBER BACKBONE:** Forms the backbone of connectivity.

**CORE CONNECTIVITY:** The data center primarily relies on the HEC ISP, leveraging its robust optical fiber backbone for a steadfast and resilient connectivity foundation.

**CAPACITY/SPEED:**

* COMSATS: 200 Mbps
* PERN (PAKISTAN EDUCATION AND RESEARCH NETWORK): 50 Mbps

**INITIATIVES:** Supporting research and academic pursuits.

**QUESTION: HEC INTERNET: ESSENTIAL OR PREFERENTIAL?**

**HEC DIGITAL LIBRARY ACCESS:**

HEC provides each university with dedicated Internet access for seamless connectivity to the HEC Digital Library. Only registered IPs by HEC can enjoy seamless access to these resources, ensuring a hassle-free and secure environment.

**WIFI INFRASTRUCTURE:**

* **USER CAPACITY:**

Catering to almost 2000 students and additional faculty/employees, the WiFi system supports a total of 2800 users. With a bandwidth capacity of 1250 Mbps, the network provides approximately 2.20 Mbps per student.

* **PUBLIC IP AVAILABILITY:**

The system maintains around 30 public IP addresses, exceeding current requirements.While only 4-5 IPs are essential for user needs, the surplus is allocated for broader university purposes.

* **SUBNETS**

45 Subnets are in place.

* **STATIC POLICY ROUTING FOR EFFICIENT TRAFFIC MANAGEMENT**

**FIREWALL CONFIGURATION:**

**POLICY ROUTING:** Ensures optimized traffic flow.

**RESEARCH WEBSITES:** Directed through HEC ISP.

**STUDENT USAGE (SOCIAL MEDIA e.tc):** Routed through PTCL.

**AHMAD JAMAL MILL:**

**NAYATEL:**

Dual connections – 150 Mbps and 25 Mbps.

* **PRIMARY ROLE:** Allocated to mobile usage for executives and users, with restrictions on social media access and also a backup for email communication.

**NEXLINKS:**

Committed Information Rate (CIR) with a capacity of 8 Mbps.

* **PRIMAERY ROLE:** Main reliance for email communication.

**TOTAL USERS:**

Approximately 150 users, including systems and mobile devices.

**PUBLIC IP UTILIZATION:**

6 public IPs from Nexlinks, with one additional IP from Nayatel currently unused.

**SUBNETS:**

3 subnets operational, meeting current requirements.

* **CISCO 2900 SERIES ROUTER IN DATA CENTER:**

**FAST UNIVERSITY**

A single Cisco 2900 Series Router is deployed in the university data center. Efficiently meeting the university requirements.

**PERFORMANCE COMAPRISON WITH A LEVEL UP (3900 SERIES)**

* **SPEED AND THROUGHPUT:**

2900 Series: Commendable throughput for small to medium-scale businesses.

3900 Series: Superior speed and reduced latency, ideal for enterprise-level networking.

* **SECURITY FEATURES ANALYSIS:**

2900 Series: Standard security protocols for essential needs.

3900 Series: Advanced encryption and authentication mechanisms for heightened protection in sensitive environments.

**ROUTING PROTOCOLS:**

* **INTERNAL ROUTING:** Utilizes static routing for internal university operations.
* **EXTERNAL ROUTING:** Implements OSPF (Open Shortest Path First) with HEC ISP for enhanced external connectivity.

**AHMAD JAMAL MILL**

No Router in place.

* **POWER BACKUP SYSTEM IN UNIVERSITY DATA CENTER: ENSURING UNINTERRUPTED DATA CENTER OPERATION**

**FAST UNIVERSITY**

**SWIFT RESPONSE AND EXTENDED BACKUP:**

* **ZD UPS:** Small ZD UPS provides an initial 5 minutes of power to the entire data center.
* **BIG BATTERY UPS:** Two large batteries supply 30 minutes of electricity during outages.
* **UNIVERSITY GENERATOR:** The university's main generator kicks in within this window.

**OPERATIONAL CONTINUITY TRIO:**

* **AUTO SHUTDOWN SAFEGUARDS:**

Triggered in cases where the generator cannot activate promptly.Prevents potential data corruption by ensuring proper server and switch shutdown.

* **SERVICE PRIORITIZATION:**

During backup operations, only primary services run on UPS to optimize resources.

* **POST-OUTAGE RECOVERY:**

Restoration after a shutdown takes 1-2 hours for full data center operation. Some devices may take 20-25 minutes to self-check during startup.

**DEPENDENCY HURDLES AND OPERATIONAL CHALLENGES:**

* **GENERATOR DEPENDENCY:**

If the university's main generator faces issues during the 30-minute UPS window, an automatic shutdown by UPS is initiated. Lack of a mechanism for generator failure necessitates manual intervention.

* **CHALLENGES AND BOTTLENECKS:**

Shutdowns are critical to prevent crashes and data loss. The absence of a foolproof mechanism for generator failure poses challenges.

**AHMAD JAMAL MILL:**

**UPS**

The facility is equipped with a robust power backup system, featuring APC UPS.

* **BACKUP:**

APC UPS coupled with a battery bank, provide an initial 30 to 40 minutes of backup power.

**AUTO-START GENERATORS:**

The generator system is designed with auto-start functionality, ensuring a swift activation within approximately 5 minutes. Continuous power supply is maintained through the seamless transition from UPS to the generator, guaranteeing uninterrupted operations.

* **NUMBER OF GENERATORS:** 3

The facility boasts three generators, providing redundancy and reliability in case of unforeseen circumstances or maintenance requirements.

* **STRATEGIC APPROACH:**

During extended holidays or organizational shutdowns, a strategic approach is adopted. Only essential services, such as email communication, remain operational 24/7.This precautionary measure ensures minimal energy consumption during periods of reduced activity.

* **ENSURED AVAILABILITY:**

Despite the rare occurrence of generator-related issues, essential staff members are always present, further mitigating potential challenges.

**STORAGE ENVIRONMENT OVERVIEW: NAS AND UNIVERSITY CLOUD**

**FAST UNIVERSITY**

**STORAGE REQUIREMENTS:**

University necessitates are over 300 TB of storage from just a rough analysis. Almost 200 TB storage capacity, scalable as needed. Over 100 TB in NVRs for a robust 15-20 days backup. Servers with 5-6 TB each, forming a modular system.

**A LITTLE LOOKUP AT NAS:**

**NAS:**

* **USAGE SCENARIO:**

Typically used in homes and small to medium-sized businesses.

* **COST AND MANAGEMENT:**

Less expensive and easy to manage.

* **SPEED AND DEPENDENCY:**

Speed dependent on local TCP/IP, usually Ethernet network, with a range of 100 Mbps to 1 Gbps.

Generally slower throughput and higher latency.

* **VIRTUALIZATION AND POINT OF FAILURE:**

Does not work with virtualization. Entry-level systems often have a single point of failure, e.g., power supply susceptible to network bottlenecks

**UNIVERSITY CLOUD:**

Own cloud features GPU clusters, scalable up to 24 GPUs per lab. Cloud cluster of GPUs installed in labs.

Easily scales with new PCs and desktops, ensuring a flexible storage environment.

* **GPU INFRASTRUCTURE:**

The university boasts a robust GPU setup with 12 core GPUs, including Tesla P40 and T4 from the NVIDIA Tensor Core series. In operation for the past 5-6 years, these GPUs have consistently served diverse computational needs.

* **POWER EQUIVALENCE:**

The power of our GPU infrastructure is equivalent to that of a supercomputer at NUST (National University of Science and Technology).

**AHMAD JAMAL MILL**

**STORAGE REQUIREMENTS:**

The cumulative data stored in the mill's data center is substantial, reaching an impressive 25-30 terabytes.

**SAN IMPLEMENTATION:**

The storage area network (SAN) is actively in operation, providing efficient data management and retrieval.

**A LITTLE LOOKUP AT SAN:**

* **USAGE SCENARIO:**

Typically used in professional and enterprise environments.

* **COST AND ADMINISTRATION:**

More expensive and requires more administration.

* **SPEED AND VIRTUALIZATION:**

High-speed using Fibre Channel, ranging from 2 Gbps to 128 Gbps. Works seamlessly with virtualization.

* **NETWORK RELIABILITY:**

Fault-tolerant network with redundant functionality. Not affected by network traffic bottlenecks.

**SERVER INFRASTRUCTURE IN THE DATA CENTER:**

**FAST UNIVERSITY**

**TOTAL SERVERS:** A comprehensive setup comprising 14 servers.

**VIRTUALIZATION STANDARD:**

All servers are virtualized and efficiently utilized, with the exception of one GPU server (dedicated to Machine Learning and AI e.tc).

* **VIRTUALIZATION PLATFORM:**

VMware is employed on Linux OS and other operating systems for efficient virtualization.

Linux OS is chosen for its versatility, allowing the opening of various OS through VMware.

**ONLINE BACKUP APPROACH:**

Data backup is exclusively conducted online through virtualized instances; no hardware backup is in place.

**SERVER DIVERSITY:**

730 servers feature different versions, aligning with the objective of virtualization.

Various hardware specifications require different operating systems, accommodating user preferences with Linux Ubuntu, Linux Fedora, and Arch Linux available for labs.

* **HARDWARE OVERVIEW:**

Servers are predominantly from DELL, featuring 6 720 DELL servers, a 740 DELL server, and a 750 DELL server.

The GPU server is equipped with a display for virtualization setup, streamlined for minimal on-site usage, as all tasks are performed remotely.

**REMOTE MANAGEMENT:**

All servers are managed and tasks are executed remotely; local management is not required.

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**TOTAL SERVERS:** A comprehensive setup comprising 5 servers.

**SERVER VARIETY:**

Diverse servers, including SAN server and DELL PowerStore, populate the data center.

* **DELL POWERSTORE:**

DELL PowerStore contributes significant storage, supporting around 18TBs of data. Out of the 5 servers, 2 are the latest DELL R750 model and a Dell R740. Recently acquired servers include 1 DELL 740 and 1 DELL 730.

**VIRTUALIZATION WITH ESXI:**

All servers, including DELL PowerStore, leverage ESXi (Elastic Sky X integrated), a powerful virtualization platform developed by VMWARE. ESXi is directly installed on the physical hardware, enabling the creation and operation of multiple virtual machines (VMs).

* **FOR DEDICATED TASK:**

One server is dedicated to specific task, but it is also virtualized.This dedicated server handles comprehensive data backup, showcasing the virtualization of backup processes.

**REMOTE SERVER MANAGEMENT:**

Server management is conducted remotely through web-based access for all virtual machines.While accessible within the organization, external access is restricted, ensuring secure and controlled management.

**NETWORK SWITCH INFRASTRUCTURE:**

**FAST UNIVERSITY**

**PTCL SWITCHES:**

Installation and Configuration: 2 switches from PTCL installed and configured by their team.

**CISCO SWITCHES:**

Cisco switches (35-60x series) managed by faculty. Layer 3 switches capable of routing functions (all switches possess routing capabilities). Models include 2900 series and 3500 series.

* **CISCO 6500 SERIES:**

Cisco 6500 series serves as a Layer 7 switch with integrated firewalls. Majority of switches are Cisco due to their reliability; rarely requiring restarts.

* **CISCO 6509 MODULAR SWITCH:**

Larger in size with numerous ports. Accommodates 24 cards within a 10-meter range. Supports Layer 7 in the OSI model.

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**SWITCH VARIETY:**

Incorporates switches from both D-Link and Cisco, providing a diverse yet integrated networking solution.

* **LAYER CONFIGURATION:**

Within the data center, all switches are configured as Layer 3 switches. Outside the data center, a mix of Layer 2 and Layer 3 switches creates a versatile and adaptable network structure.

**TOTAL SWITCH COUNT:**

The data center houses a total of 5 switches, comprising 1 D-Link switch and 4 Cisco switches.Each switch is equipped with 48 ports, collectively forming a robust networking backbone for the mill's operations.

**NVRs AND CAMERA INFRASTRUCTURE:**

**FAST UNIVERISTY**

**NVR FUNCTIONALITY:**

Dedicated for camera traffic, managing recording, streaming, and related operations. Impressive 15-20 days backup, with variations based on the significance of data. Storage duration ranges from a minimum of 5-6 days to a potential maximum of 2 months, catering to varying importance levels.

* **DIVERSITY IN NVR DEVICES:**

Utilizes NVR devices capable of handling 350+ cameras simultaneously.

**CAMERA NETWORK:**

Cameras operate 24/7, contributing to comprehensive surveillance coverage.Continuous camera monitoring ensures real-time surveillance effectiveness.

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**NVR CAPACITY:**

Utilizes 2 Network Video Recorders (NVRs), each boasting an impressive 64TB (terabytes) capacity.

* **BACKUP:**

One NVR ensures a backup period of over 2 and a half months, providing extensive surveillance data retention. The second NVR offers a backup duration of approximately 1 and a half to 2 months, ensuring ample coverage for critical periods.

**CAMERA COUNT:**

The comprehensive camera network consists of a total of 110 cameras, strategically positioned for surveillance coverage.

**FIREWALL INFRASTRUCTURE:**

**FAST UNIVERSITY**

**COMPONENTS:**

Utilizes 2 hardware and 3-4 software firewalls for robust security measures. Effective blockage of illegal access attempts ensures the integrity of the network.

* **SOFTWARE FIREWALLS:**

Runs 3-4 software firewalls, including dynamic solutions like Casper Sky Antivirus, updated periodically for enhanced protection.

**EVOLUTION SINCE 2013:**

Pre-2013 lacked a firewall, leading to vulnerabilities and attacks. Post-implementation, the network has remained secure.

**MANUAL BLOCKING AND CONTENT FILTERING:**

Manual intervention blocks numerous malicious users, ensuring a proactive security approach.

Content filtering restricts access to inappropriate content such as nudity and gambling.

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**FIREWALL CONFIGURATION:**

Employs a dual hardware firewall setup, enhancing security measures within the data center. Specifically, both firewalls are of the Sophos XG 125 model, known for their advanced threat protection capabilities.

* **SOPHOS XGS SERIES:**

Leveraging Sophos XGS Series firewalls, the data center benefits from a powerful combination of high-performance, multi-core CPUs for efficient deep-packet inspection.

**HIGH AVAILABILITY/FAULT TOLERANT:**

Operates in a high-availability setup, ensuring continuous protection. If one firewall is inactive or down, the second seamlessly takes over.

**BLOCKING:**

Implements strict security policies, with a notable emphasis on restricting access to most of social media platforms.

**NETWORK SYSTEM INFRASTRUCTURE:**

**FAST UNIVERSITY**

**OVERVIEW:**

The entire university network operates cohesively, with each fiber boasting a robust 10 GB capacity. The central data center acts as the hub, connecting all fibers and wires from various university sections.

* **SDM NETWORK TECHNOLOGY:**

Npq3064x SDM network, the latest in technology, is prominently employed. It comprises all ports, featuring 408x 10 Gbps capabilities and an additional 4 ports with 40 Gbps capacities.

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**BACKBONE:**

The primary fiber optic network is sourced from Nayatel, ensuring high-speed and reliable connectivity to the data center.

* **FIBER OPTIC EXPANSION:**

In cases where the location is distant, additional fiber optic cables are deployed within the mill to guarantee seamless connectivity.

* **AUDEKS CABLES:**

2 Audteks cables, each consisting of 12 pairs, contribute to the robust fiber infrastructure.

**CAT6 NETWORK CABLE:**

Complementing the fiber backbone, CAT6 cables are in use, providing a bandwidth capacity of 250 MHz. These cables facilitate high-speed data transmission, offering speeds of up to 10 Gbps.

**WIFI ACCESS POINTS:**

The network is further extended with the establishment of approximately 10-12 WiFi access points.

These access points enhance wireless connectivity within the mill's premises, ensuring comprehensive network coverage.

**TELEPHONE COMMUNICATION SYSTEM:**

**FAST UNIVERSITY**

**SYSTEM CAPACITY:**

The telephone communication system encompasses 100 full numbers. Utilizes a 4-wire configuration to facilitate robust and extensive communication capabilities.

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**IP EXCHANGE:**

The telephone system at the mill operates through an IP exchange, leveraging modern technology for efficient communication.

* **IP-BASED TELEPHONES:**

There are a total of 55 IP-based telephones, offering advanced features and functionalities. IP-based telephones are integrated with the network through dedicated network cables.

* **COST CONSIDERATIONS:**

IP-based telephones are noted to be a costlier option, reflecting the advanced capabilities they bring to the communication infrastructure.

**ANALOG TELEPHONES:**

Additionally, there are 55 analog telephones in use, providing a versatile communication solution. Analog telephones utilize traditional 4-wire telephone lines for connectivity.

**DATA CENTER MONITORING AND MANAGEMENT SUITE:**

1. **DEVICES HEALTH TRACKING:**

**FAST UNIVERSITY:**

* **REMOTE MONITORING:**

Health and performance of devices are tracked online through dedicated software. Comprehensive monitoring includes health status, performance metrics, and other vital parameters, all managed remotely. Different software tools, such as LIBRA and Solar Vix, are deployed based on specific requirements for maintaining optimal device health.

* **TEMPERATURE MONITORING:**

Room temperature is critical, with an alarming threshold set at 40 degrees Celsius for the data center.

Rigorous monitoring OF individual device temperatures, and even port temperatures is done (with some capable of tolerating up to 75 degrees Celsius).

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* **NETWORK MONITORING:**

SolarWinds is employed for network monitoring, ensuring real-time visibility into the health and performance of the entire network infrastructure.Remote access to servers is facilitated through web-based consoles, providing insights into their operational status.

**VIRTUALIZATION PLATFORM:** The ESXi virtualization platform, developed by VMware, contributes to device monitoring, offering insights into the health and performance of virtualized servers.

* **TEMPERATURE CONTROL:**

The data center maintains a controlled temperature environment, with temperatures ranging from 20 to 22 degrees Celsius. Continuous monitoring through security cameras ensures a stable and optimal operating temperature.

**NETVOX DEVICE MONITORING:** Netvox devices are implemented for temperature and humidity monitoring in server rooms.These devices allow setting thresholds for both minimum and maximum values, generating email alerts when thresholds are reached.The maximum threshold for temperature is set at 25 degrees Celsius.

1. **AUDIT PROCEDURES:**

**FAST UNIVERSITY**

* **FREQUENT AUDITING:**

Audits are conducted regularly to ensure the integrity and efficiency of the system. Regular findings provide insights into the system's performance, uncovering potential areas for improvement.

Technical faults identified during audits are thoroughly examined and promptly addressed. Solutions are implemented to rectify any discrepancies, enhancing the overall reliability of the system.

* **COMPREHENSIVE DOCUMENTATION:**

Each audit is meticulously documented, creating a comprehensive record of the system's state at various points in time.

**AHMAD JAMAL MILL:**

* **ESTABLISHED POLICIES:**

The data center operates under a set of robust policies including IT security policy, risk management policy, and backup policy. The development of the Disaster Recovery and Business Continuity (DRB) policy is in progress, with documentation being the final phase. The DRB policy emphasizes transparency in handling Personal Information, aligning with privacy and data protection laws. Documentation of the DRB policy is nearing completion, ensuring comprehensive coverage of disaster recovery measures.

* **TRANSPARENCY COMMITMENT:**

**EXTERNAL AUDIT BY EY:** External audits are conducted periodically by Ernst & Young (EY), a renowned multinational professional services firm.EY, part of the prestigious Big Four accounting firms, provides insights through documentation of weaknesses and proposes plans for the upcoming year.

1. **STAFF'S LATEST TECHNOLOGY AWARENESS:**

**FAST UNIVERSITY**

* **SUBSCRIPTIONS FOR CONTINUOUS LEARNING:**

Faculty members stay abreast of the latest technology trends through subscriptions to platforms like LinkedIn and Udemy. Regular engagement with these platforms ensures continuous learning and quick adoption of emerging technologies within the data center.

**AHMAD JAMAL MILL**

* **ANDROID AND IPHONES USAGE:**

According to them, in today age, staff members seamlessly integrate the use of Android and iPhones into their daily operations.The prevalence of these devices contributes to a technologically connected and efficient work environment.

* **SAP BUSINESS 1 IMPLEMENTATION:**

The data center employs SAP Business 1, an Enterprise Resource Planning (ERP) solution tailored for small businesses. This ERP solution streamlines and integrates various business processes, enhancing overall operational efficiency. The utilization of SAP Business 1 incurs an annual cost, reflecting the investment in cutting-edge technology to optimize business workflows.

1. **USER ACCESS CAPACITY:**

**FAST UNIVERSITY**

* **CONFIDENT HANDLING:**

The data center boasts confident faculty members who welcome challenges, even suggesting attempting a DDoS attack to showcase their robust infrastructure.

**NOTE:** They don't know whom they are challenging, but due to a shortage of time and the semester running over, they managed to survive.

**AHMAD JAMAL MILL:**

As this is confidential we have not ask about this from their data center faculty.

1. **AUDIT AND ACCESSIBILITY MONITORING:**

**FAST UNIVERSITY:**

* **SECURITY PROTOCOLS IN PLACE:**

Access to sensitive data is closely monitored through enabled audit and accessibility tracking. Regular logging of activities ensures a vigilant approach, enhancing overall data security within the system.

**AHMAD JAMAL MILL:**

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**COST OVERVIEW:**

**FAST UNIVERSITY:**

**TOTAL ESTIMATION:**

The estimated cost of the entire data center surpasses 5 crores.

* **RECENT PROCUREMENTS:**

Two servers were recently acquired, costing approximately 50 lacs. Each hard drive carries an individual cost of 50,000. A second-hand Cisco 2900 series router was acquired at a cost of almost 15 lacs in 2018.

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**CONFIDENTIAL NATURE:**

Specific details regarding the precise cost structure of the data center were not explicitly disclosed during discussions with the data center faculty. The substantial technological infrastructure, including hardware, software, and specialized services, suggests a significant investment in maintaining a state-of-the-art data center.

**VULNERABILITIES IN DATA CENTER INFRASTRUCTURE:**

1. **FIRE DETECTION AND HANDLING:**

**FAST UNIVERSITY**

* **ABSENCE OF FIRE DETECTION SYSTEM:**

A critical vulnerability lies in the lack of a fire detection system, ranking among the most significant weaknesses. Without a means to detect fires promptly, the data center is exposed to potential catastrophic risks.

* **EMERGENCY RESPONSE MECHANISM (IN CASE OF FIRE):**

The absence of a structured mechanism to deal with fire emergencies heightens the vulnerability.In unforeseen situations, the lack of predefined plans to tackle fire incidents poses a significant risk.

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* **COMPREHENSIVE FIRE DETECTION/HANDLING:**

The data center is equipped with a robust fire detection system, ensuring early identification of potential fire incidents. The FM-200™ sprinkler system, known for its effectiveness, is employed to safeguard equipment by swiftly responding to detected smoke.

* **FM-200™ CLEAN AGENT SYSTEM:**

The FM-200™ Clean Agent system, also referred to as HFC-227ea, is utilized for fire suppression against Class A, B, and C fires. Compliant with NFPA Standard 2001 Clean Agent Fire Extinguishing Systems, FM-200™ offers fast and residue-free fire suppression.

1. **OFFSITE PLACEMENT LACKS STRATEGY:**

**FAST UNIVERSITY**

* **LIMITED EMERGENCY RELOCATION PLANS:**

The absence of a mechanism for offsite placement during emergencies adds another layer of vulnerability. In contrast to well-prepared data centers, the lack of plans for unexpected disasters leaves the data center at risk of historical extinction.

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* **EXTERNAL BACKUP:**

The data center ensures offsite placement through external backup mechanisms to mitigate risks associated with unexpected natural disasters. In the event of events like earthquakes or floods, data is backed up externally, safeguarding against potential data loss.

* **DISASTER RECOVERY SITE:**

A dedicated disaster recovery site is established, equipped with machine backups to facilitate rapid recovery in case of a catastrophic event.

* **COMPREHENSIVE BACKUP STRATEGY:**

The data center boasts a robust backup strategy, with almost every critical element being backed up, ensuring a resilient and secure approach to data management.

1. **NOISE MANAGEMENT CHALLENGES:**

**FAST UNIVERSITY**

* **HIGH NOISE LEVELS:**

The noise generated by data center devices poses a considerable challenge. While efforts are made to contain it within a separate transparent room, there is no comprehensive mechanism to address or resolve the noise issue.

**AHMAD JAMAL MILL**

According to them, noise not posing a significant challenge, there is no specific mechanism in place for noise handling.

**ADHERENCE TO IOS STANDARDS:**

**FAST UNIVERSITY**

**COMPLIANCE STATUS:**

The data center adheres to the majority of IOS standards, ensuring a robust and secure operational framework. However, certain vulnerabilities persist, as discussed earlier, revealing areas where compliance falls short.

* **CERTIFICATION CHALLENGES:**

Despite efforts, the data center faces challenges in obtaining certification, notably in the domain of fire detection and handling.

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**INDUSTRY PRACTICES:**

On asking, the reply was that the data center acknowledges the importance of industry standards and practices in ensuring operational excellence. While telecom companies may find certification crucial, the industrial context may not necessitate adherence to such stringent standards.

**FINAL VERDICT**

In our assessment, Ahmad Jamal demonstrates efficiency in managing various aspects, particularly excelling in fire detection, handling, and robust backup procedures. Given its status as a privately owned industry giant, the absence of a router may not be a drawback if it's unnecessary for their operations.

Fast University's data center stands out for its overall efficiency, handling many tasks adeptly. However, there are areas of improvement, notably in fire detection, handling, and potentially backup strategies in the future. Despite challenges, both Ahmad Jamal and Fast University undergo professional audits, although Ahmad Jamal appears to have a more robust audit process.

In conclusion, both excel in their respective domains, but when comparing the two, Ahmad Jamal emerges as the preferred choice, taking into account its notable strengths in critical areas.