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Cloud services are online tools that let you store and manage things like photos, videos, and software on the internet instead of keeping them only on your personal device. They work like a digital locker that you can open from anywhere, giving you access to your files whenever you need them. This makes it easier to work on different devices and reduces the need for physical storage. Popular examples include Google Drive, Dropbox, and iCloud. Since your data is stored online, strong security measures such as encryption and password protection are important to keep it safe.

In everyday life, many people and businesses use Google Drive to save their documents, photos, and videos online rather than on a single computer. It's a simple way to back up important files, collaborate with others, and access information from any device, wherever you are. For companies, cloud services offer the same convenience on a larger scale they can store data, run applications, and analyze information without having to manage all the hardware themselves.

Problem

In Yaoundé, Cameroon, many schools such as Lycée Bilingue d'Emana and Lycée de Mendong — still rely on paper to store important documents like student records and payment receipts. This approach often leads to several problems, including:

- Loss of files due to fire, theft, or poor storage conditions
- Difficulty finding or sharing documents quickly

- Lack of backup and protection for sensitive information

These challenges make administrative work slower and less secure. A practical solution is to move to cloud based systems, which allow schools to store and manage their documents online safely, with quick and easy access from anywhere.

Solution to this problem.

To improve how schools like Lycée Bilingue d'Emana and Lycée de Mendong manage their documents, the proposed solution brings together cloud-based platforms and wide area network (WAN) technology. This combination allows schools to store, share, and access digital records securely from different locations, while keeping the system flexible and easy to scale as the school grows.

Integrated Cloud-WAN Architecture

By converting paper files into digital format and storing them in the cloud, schools can avoid the risks linked to physical storage such as loss, damage, or theft and make it faster to find and share information. To make sure that all departments or campuses can access this data safely and reliably, the cloud setup should be supported by WAN technology. This ensures smooth communication, secure connections, and continuous access to online resources from any location.

What to Put in Place for the Cloud Part to Work Properly

When a school decides to move its documents to the cloud (using services like Google Workspace for Education or Microsoft 365 Education), it's not just about uploading files. Several key elements must be set up to make the system secure, reliable, and efficient.

1. Reliable Internet Connection

The cloud operates entirely online, so a stable and fast internet connection is essential. This ensures staff can upload, download, and access files smoothly without interruptions.

It's also advisable to have a backup internet provider in case the main one fails. Schools can connect through fiber or 4G routers, and all branches can be linked via a WAN or VPN connection.

Example:

Each school site connects through fiber internet, while different campuses are connected via a secure VPN for shared access to the cloud.

2. Cloud Service Account (Platform Setup)

The school must create an account with a cloud provider such as Google Workspace for Education or Microsoft 365 Education.

These platforms include essential tools like:

- Google Drive / OneDrive for storing documents
- Google Docs / Word Online for editing and collaboration
- Google Meet / Teams for communication

This forms the central digital workspace where all academic and administrative files are managed.

Example:

The school administrator creates accounts for teachers, accountants, and secretaries under a single cloud domain (for example: *@lyceeemana.cm*).

3. Structured Cloud Storage System

A well-organized storage structure makes file management easier. Create separate folders for each department (Administration, Finance, Discipline, Exams, etc.), and use consistent naming conventions such as "Receipt_2025_StudentName.pdf" for easy tracking.

Example:

Each department has its own shared folder in Google Drive or SharePoint with limited access rights.

4. User Accounts and Access Control

Each staff member should have a unique account with specific permissions. Implement role-based access control to define who can view, edit, or delete files.

For instance:

- Finance staff can open or modify payment records.
- Teachers can view but not edit certain administrative documents.

This approach ensures security, traceability, and accountability.

Example:

In Google Workspace, the IT administrator assigns roles such as Viewer, Editor, or Admin to each user.

5. Automatic Backup and Data Protection

Although most cloud platforms automatically back up data, it's still important to add an extra layer of protection.

Schools can schedule weekly or monthly exports of key files to another cloud service or external hard drive.

Keeping an offline copy of critical data prevents total loss in case of system failure.

Example:

All student records are backed up monthly to a second cloud account and an external hard drive.

6. Security Configurations

To keep school data safe from cyber threats:

- Use strong passwords and two-factor authentication (2FA).

- Enable data encryption (most providers do this automatically).
- Restrict access to specific devices or IP addresses.

Example:

If a staff member's phone is stolen, the IT admin can remotely log them out from the cloud dashboard.

7. Staff Training

Even the best system can fail if users aren't properly trained. Organize training sessions to teach staff how to:

- Upload, share, and organize files correctly
- Follow data privacy and security rules
- Collaborate efficiently online

Example:

A one-day workshop can be held to teach staff how to use Google Drive and Docs for school reports.

8. Maintenance and Monitoring

Assign one IT administrator (or a small team) to monitor the system regularly. Their responsibilities include:

- Checking storage usage and performance
- Reviewing account activity and security logs
- Verifying backup status
- Cleaning unused or inactive accounts

Example:

At the end of each month, the IT admin reviews the system to ensure all accounts remain active and secure.

What We Need to Put in Place for the WAN Part to Work Properly

The proposed network setup connects the four main departments of the school — **Administration, Finance, Academic, and Library** — into one integrated system that supports both **cloud computing** and a **wide area network (WAN)** connection. This design aims to make data sharing, storage, and communication across departments more efficient and secure.

1. Department-Level Setup (Local Area Networks)

Each department has its own **local area network (LAN)**, built using a dedicated switch that connects all the computers and devices within that department. For example:

- The **Administration switch** connects office computers, printers, and other devices used by school administrators.
- The **Finance switch** connects staff responsible for payment records and accounting.
- The **Academic switch** links computers used by teachers and academic staff.
- The **Library switch** connects the catalog system, librarian PCs, and student access terminals.

This separation ensures that every department can function independently while still remaining part of the larger school network. Each switch helps control traffic and limits data congestion within its own department.

2. Central Switch (Network Core)

All four departmental switches are connected to a **central switch**, which acts as the **main communication point** for the entire school network. This central switch aggregates the data from each department and manages the flow of information between them.

By using **VLANs (Virtual Local Area Networks)** on the central switch, network traffic can be segmented logically — keeping each department's data private while allowing secure communication when needed. This improves both performance and network security.

3. Server Integration

The **server** is connected directly to the central switch. It functions as the **internal data center** for the school, handling services such as:

- File storage and backups
- Authentication and user management
- Application hosting (e.g., student record systems or internal databases)

This server allows departments to save and access documents locally before synchronization with the cloud. It also helps reduce internet dependency — staff can still access some resources even when the internet connection is temporarily down.

4. Router Connection (Gateway to the WAN)

The server and central switch are connected to a **router**, which serves as the gateway to external networks.

The router connects the local school network (LAN) to the **wide area network (WAN)** and the **cloud service provider**.

It handles:

- IP address assignments
- Routing of data between the internal network and the internet
- Firewall and security filtering to protect internal systems

Through the router, all departments can securely access the cloud platform and share information with other campuses or remote users.

5. Firewall (Security Layer)

Placing a firewall **between the router and the cloud** adds a critical security layer.

- All traffic leaving the school network toward the cloud passes through the firewall, which blocks unauthorized access and potential threats.

- Similarly, incoming traffic from the cloud is inspected before it reaches the router or any internal devices.
- This protects sensitive student records, financial data, and other internal documents from cyberattacks.

6. Cloud Connectivity (Remote Storage and Access)

Finally, the router connects to the **cloud infrastructure**, where all digital records, backups, and academic data are stored online. This allows authorized staff to:

- Access documents from any location
- Collaborate in real time
- Keep sensitive data safe through encrypted cloud storage

Cloud services (like Google Workspace or Microsoft 365) ensure automatic data backup, reducing the risk of losing files due to theft, fire, or hardware failure.

Design

